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- Scientific and technical reports of the National Aeronautics and Space Administration and its contractors.
- Scientific and technical reports of government agencies, universities, and research organizations throughout the world.

The first section of *STAR*, arranged in 34 categories, contains abstracts and bibliographic citations (see p. vi). A second section consists of five indexes: subject, author, corporate source, report/accession number, and accession/report number. Separate cumulative indexes are published quarterly, except for the fourth quarter, which is an annual index. Cumulative indexes also contain a contract number index.

Readers are encouraged to examine the abstracts in each category of interest. If time is short, and when interest is concentrated in specific areas, readers may wish instead to scan source, author, and subject indexes. A more thorough coverage of a subject field may often be achieved by detailed examination of the subject listings, especially as they are cross-indexed in the quarterly indexes.

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Organizations having a NASA contract may obtain *IAA* by writing NASA, Code USS-A, Washington, D.C., 20546. Others should direct inquiries to the American Institute of Aeronautics and Astronautics, 750 Third Avenue, New York, N.Y. 10017

Table of Contents

Volume 5 Number 3 / February 8, 1967

Abstracts in the journal are grouped under the following categories: **PAGE**

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. 331

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. 332

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. 334

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. 337

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. 349

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. 354

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. 363

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. 369

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 372

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. 374

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. . . . 379

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. 382

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. 385

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. 392

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, reliability; drafting; and materials fabrication, handling, and inspection. 400

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. 406

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. 408

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. 414

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. 415

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 417

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 420

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 421

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 428

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 432

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 447

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 451

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. . . . . **No Abstracts**

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 455

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 456

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 459

31 SPACE VEHICLES
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. 466

32 STRUCTURAL MECHANICS
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. 468

33 THERMODYNAMICS AND COMBUSTION
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. 471

34 GENERAL
Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. 475

SUBJECT INDEX I–1

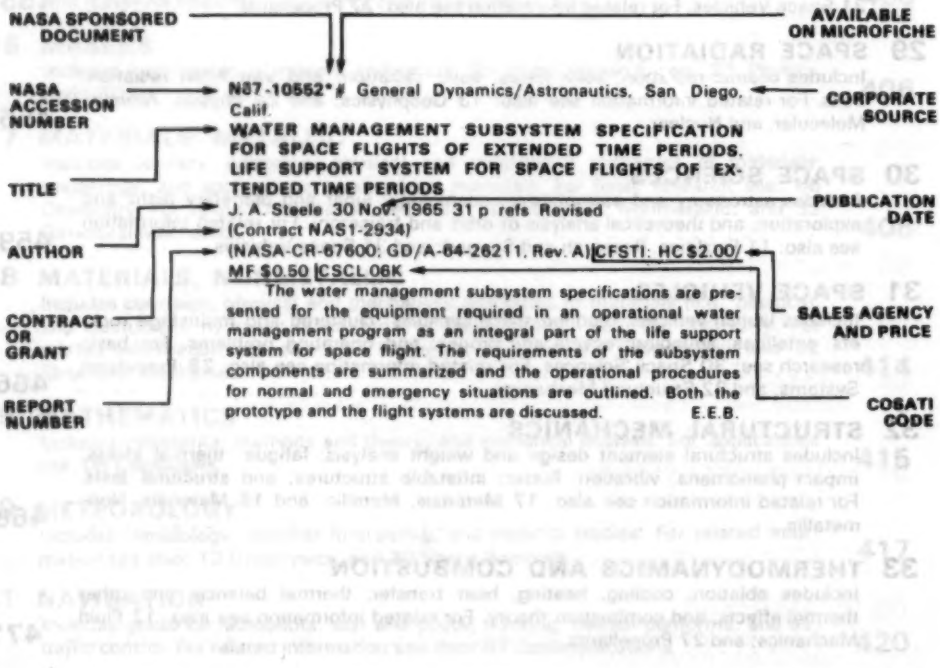
PERSONAL AUTHOR INDEX I–49

CORPORATE SOURCE INDEX I–73

REPORT/ACCESSION NUMBER INDEX I–87

ACCESSION/REPORT NUMBER INDEX I–95

TYPICAL CITATION AND ABSTRACT FROM *STAR*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N87-10552*# General Dynamics/Astronautics, San Diego, Calif.
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TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
(Contract NAS1-2934)
(NASA-CR-67600; GD/A-64-26211, Rev. A)
CONTRACT OR GRANT
REPORT NUMBER
CFSTI: HC $2.00/MF $0.50
CSCL 06K
SALES AGENCY AND PRICE
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed.
E.E.B.
COSATI CODE

VOLUME 5 NUMBER 3

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N67-12473# Royal Aircraft Establishment, Farnborough (England).
THE INCREASE IN WAVE DRAG IN SUPERSONIC SPEEDS DUE TO SURFACE WAVINESS
K. G. Smith Aug. 1966 67 p refs
(RAE-TR-65173; AERO-2745) CFSTI: HC $3.00/MF $0.75

The linearised theory results of Nielsen for the wave drag due to two and three dimensional types of surface waviness on circular cylinders are discussed, and compared with results obtained by using two dimensional linearised theory and slender body theory, and with the results for waviness on a flat plate. It is shown that for the types of waviness likely to arise in practice the increase in wave drag is almost the same for waviness on flat plates and circular cylinders, so that the results may be used with some confidence to predict the increase in wave drag due to surface waviness in bodies of various other basic shapes. The theoretical results for two dimensional waviness agree satisfactorily with the small amount of available experimental data. Author

N67-12882# Aeronautical Research Labs., Melbourne (Australia).
LONGITUDINAL CHARACTERISTICS OF AN EXTENDED TAPERED WING VERSION OF THE JINDIVIK TARGET AIRCRAFT
L. F. O'Brien Nov. 1965 40 p ref
(ARL/A-253) CFSTI: HC $2.00/MF $0.50

To ascertain the aerodynamic characteristics of an extended span tapered wing version of Jindivik, measurements of lift, pitching moment and drag have been made in the A.R.L. Transonic Wing Tunnel on a 1/12th scale half model of the Mk. 3A. aircraft. The model was fitted with a tapered wing extension, and it was tested both with the Mk. IV and with the Mk. VI AMPCR pods represented. The lift coefficient range was from −0.1 to 0.8 and the Mach number range was from 0.5 to 0.95. The flap was set at nominally +4°. Tailplane and elevator angles were varied for the model fitted with the Mk. VI pod so that tailplane and elevator angles to trim could be obtained for this configuration. Downwash at the tailplane was also determined. Author

N67-13041# Aeronautical Research Inst. of Sweden, Stockholm.
VORTEX LATTICE METHOD FOR CALCULATION OF QUASI STEADY STATE LOADINGS ON THIN ELASTIC WINGS IN SUBSONIC FLOW
Sven G. Hedman 1966 19 p Sponsored in part by SAAB Co.
(FFA-105) CFSTI: HC $1.00/MF $0.50

Wing systems that contain several wing surfaces are considered. The surfaces are arbitrarily divided in the chordwise and spanwise directions into panels boxes. The panel load is simulated by a horseshoe vortex, and the boundary condition is fulfilled on every panel at one point. For each surface the vortices and the control points are positioned on a wing chord plane. These planes are perpendicular to the y- or z-axis. The incidence distribution or the load distribution may be found from a system of linear equations, when one of these distributions is given. The calculations can be performed for elastic wings, if the elastic properties are known in the form of a deformation matrix. The calculation procedure has been programmed for an electronic computer. Good correlation has been obtained between the results from this method and those from other lifting surface method or experiments. Author (ESRO)

N67-13121*# Northrop Corp., Hawthorne, Calif. Norair Div.
A THEORETICAL STUDY OF THE AERODYNAMIC CHARACTERISTICS OF LIFTING-BODY ENTRY VEHICLES Summary Report, Mar. 1965–Mar. 1966
James R. Stevens, Maurice S. Cahn, William E. Grahame et al
May 1966 26 p
(Contract NAS2-2671)
(NASA-CR-80436; NOR-66-72) CFSTI: HC $2.00/MF $0.50
CSCL 01A

Theoretical analyses of the aerodynamic characteristics of the lifting body class of vehicles are presented. Emphasis is placed on the evolution of simplified methods representing an engineering approach. Methods presented are: lifting surface theory, slender body theory using apparent mass methods, viscous crossflow and vortex tracking theory, shock-expansion theory, area rule wave drag, modified Newtonian and exponential flow theory, three-dimensional method of characteristics, and empirical correlations. Longitudinal, lateral-directional, and dynamic forces were studied; and theoretical estimates of the aerodynamic characteristics of the M-2 and HL-10 lifting bodies were compared with experimental test results. S.P.

N67-13147# Royal Aircraft Establishment, Farnborough (England).
GENERAL PERTURBATION THEORY FOR FREE FLIGHT OF A BALLISTIC MISSILE
G. B. Longden Mar. 1966 38 p refs
(RAE-TR-66088) CFSTI: HC $2.00/MF $0.50

The report draws together work on accuracy derivatives and on some specific perturbations in order to formulate the general first-order effects of ballistic missile trajectory perturbations. Some remarks are added on an approach to second-order effects. The formulae are applicable not only to ballistic missiles but to any space vehicle moving in a central field of force whose position, rather than its orbital elements, is of interest. Author

N67-13168*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SERIES OF RELATED BODIES WITH CROSS-SECTIONAL ELLIPTICITY

Bernard Spencer, Jr. Washington, NASA, Feb. 1966 75 p refs
(NASA-TN-D-3203) CFSTI: HC$3.00/MF$0.75 CSCL 01A

The transonic characteristics of volumetrically efficient lifting bodies were investigated with power-law configurations and with a theoretical body for minimizing zero-lift pressure drag at hypersonic speeds. The Mach number was varied from 0.50 to 1.12, the angle of attack ranged from approximately 6° to 28° at 0° sideslip, and the cross sectional ellipticity was also varied. The results are graphed. It was found that: (1) Increasing power-body exponent increases the lift-curve slope at low angles of attack and the overall lift variation with angle of attack. The maximum lift–drag ratio for the power-law bodies was obtained with the lowest power-body exponent. (2) Increasing ellipticity for any power-law body resulted in large increases in lift and maximum lift–drag ratio, with only slight effects on center-of-pressure location. (3) The overall aerodynamic characteristics of the theoretical body are similar to those with a power-law body having an exponent of 0.50, and the values of maximum lift–drag ratio were slightly higher than those for the power-law bodies for all values of ellipticity. N.E.N.

N67-13170*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENT BY WAKE MOMENTUM SURVEYS AT MACH 1.61 AND 2.01 OF TURBULENT BOUNDARY-LAYER SKIN FRICTION ON FIVE SWEPT WINGS
Russell B. Sorrells III, Mary W. Jackson, and K. R. Czarnecki Washington, NASA, Dec. 1966 30 p refs
(NASA-TN-D-3764) CFSTI: HC$2.00/MF$0.50 CSCL 01A

Momentum surveys were made in the wakes behind five semispan swept wings at Mach numbers of 1.61 and 2.01 to study the feasibility of this method of measuring the turbulent three-dimensional boundary-layer skin friction of the models. The wings had the same planform but employed various amounts of twist and camber. Transition was fixed and the free-stream Reynolds number, based on mean geometric chord, was 2.9×10^6 for both Mach numbers. The section skin-friction coefficients were calculated and the average skin-friction coefficient for the wing was compared with that obtained by the Sommer and Short T' flat-plate theory. The results indicate that wake surveys can measure the viscous and separation momentum losses incurred by a swept wing with reasonable accuracy and that the viscous momentum losses can be related to section skin-friction coefficient with reasonable accuracy except when there is an appreciable amount of separation on the wing. It appears that for a high order of accuracy, wake surveys should be taken far enough downstream of the model to insure that the static pressure will be essentially constant through the wake at the particular spanwise station being surveyed. The integrated skin-friction values over the span are slightly greater than the integrated values from theory for the wings which had little or no flow separation. The cambered wings indicate values much greater than those obtained from theory because of a large amount of separated flow on the wings. Author

N67-13171*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A CONCEPT OF THE VORTEX LIFT OF SHARP-EDGE DELTA WINGS BASED ON A LEADING-EDGE-SUCTION ANALOGY
Edward C. Polhamus Washington, NASA, Dec. 1966 17 p refs
(NASA-TN-D-3767) CFSTI: HC$1.00/MF$0.50 CSCL 01A

A concept for the calculation of the vortex lift of sharp-edge delta wings is presented and compared with experimental data. The concept is based on an analogy between the vortex lift and the leading-edge suction associated with the potential flow about the leading edge. This concept, when combined with potential-flow theory modified to include the nonlinearities associated with the exact boundary condition and the loss of the lift component of the leading-edge suction, provides excellent prediction of the total lift for a wide range of delta wings up to angles of attack of 20° or greater. Author

N67-13220# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
FLOW SEPARATION IN HIGH-SPEED FLIGHT: A REPORT BIBLIOGRAPHY
F. I. Clayton and J. E. Wuerer Sep. 1966 103 p refs
(DAC-59101)

A report bibliography is presented listing by year reports that contain information pertinent to the flow separation problem. A brief synopsis of the information contained in each report is tabulated. Author

N67-13229 Aeronautical Research Labs., Melbourne (Australia).
DESIGN, PERFORMANCE AND ANALYSIS OF DUCTED AXIAL FLOW FANS
R. A. Wallis [1955] 165 p refs
(A-88)

A method of designing ducted axial flow fans is presented for the case of a fan rotor with pre-rotators upstream and straighteners downstream. The design equations are applicable to any stator–rotor combination and can also be used for centrarotating fans. The design method, which is direct, is developed in terms of two parameters; the flow and swirl coefficients. Recommendations for calculating the losses in the rotor, stators and over the tail fairing give an estimate of efficiency which is adequate for design purposes. As the method lends itself to graphical solution, the design variables have been presented as simple functions of the above two parameters. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N67-12499# Library of Congress, Washington, D. C. Aerospace Technology Div.
HERMETICALLY SEALED HULL COMPARTMENTS AND METHODS OF CALCULATING THEIR STRENGTH
B. L. Bel'skiy, I. P. Vlasov, V. N. Zaytsev, S. N. Kan, V. P. Kamozhitskiy et al *In its* Soviet High-altitude Equipment for Aircrew Protec. 9 Jun. 1966 p 66–72 Transl. into ENGLISH from "Konstruktsiya Letatel'nykh Apparatov: Samolety, Rakety, Vertolety" Moscow, Oborongiz, 1963 p 387–393 (See N67-12494 03-05)

Pressurized cabins are classified as ventilation type, in which a continuous flow of air from the atmosphere is forced into the cabin by a compressor; and regeneration type, in which the cabin atmosphere is supplied from air and oxygen tanks. The advantages and limitations of each are assessed, and it is pointed out that the ventilation-type cabin is impractical at altitudes above 20 km. The generative type has the limitations of relatively great weight, and flight duration; and greater danger of fire. Pressurized cabin design is discussed, with hermetic sealing and thermal insulation identified as the main construction problems. Methods used in sealing riveted seams and all possible exits, conduits, and other breaks in the cabin are summarized. The requirements for thermal insulation are listed, and it is mentioned that most insulation panels are made of special plastic foam, fiber glass, and fiber glass fabric, with the thickness dependent on outside skin heating. M.G.J.

N67-12500# Library of Congress, Washington, D. C. Aerospace Technology Div.
HIGH ALTITUDE EQUIPMENT

Ye. V. Sofronov *In its* Soviet High-altitude Equipment for Aircrew Protec. 9 Jun. 1966 p 73–75 Transl. into ENGLISH from "Oborudivaniye Samoleta" Moscow, Izd-vo "Znaniye", 1965 p 30–33 (See N67-12494 03-05)

The partial pressure of the component gases of the atmosphere, and the total pressure, density, temperature, and humidity of the air are reviewed in relation to the requirements which must be met for high altitude equipment and pressurized aircraft cabins. The symptoms of oxygen starvation at various altitudes are discussed to show the need for maintaining adequate partial oxygen pressure. A combination of pressurized cabin, high altitude clothing, and oxygen breathing apparatus is usually used to assure flight safety and normal work capacity at any altitude with a minimum equipment weight penalty. The important features of each are outlined. M.G.J.

N67-12793*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NOISE MEASUREMENT VALUATIONS OF VARIOUS TAKE-OFF–CLIMBOUT PROFILES OF A FOUR–ENGINE TURBOJET TRANSPORT AIRPLANE

W. Latham Copeland, David A. Hilton, Vera Huckel, Andrew C. Dibble, Jr., and Domenic J. Maglieri Washington, NASA, Dec. 1966 53 p refs

(NASA-TN-D-3715) CFSTI: HC $2.50/MF $0.50 CSCL 01C

Noise measurement evaluations have been conducted on a four-engine turbojet transport airplane for several climbout profiles involving various climb speeds, flap settings, and engine pressure ratios; these data were correlated with airplane operations and position data. The main result of these studies is that power reductions during second segment climb generally result in reduced noise levels on the ground compared with those associated with a full–power take–off climbout. The amount of noise reduction attained depends upon the amount of power reduction, and the noise level profile on the ground is related directly to the engine power schedule. Tables and figures are presented to show detailed comparisons. Author

N67-12952# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.

FLOTATION CHARACTERISTICS OF AIRCRAFT-PASSENGER SEAT CUSHIONS

Ernest B. McFadden and James M. Simpson Apr. 1966 17 p refs

(AM-66-13)

Flotation characteristics of aircraft seat cushions were evaluated with respect to their utilization as individual flotation devices. When statically tested with an inanimate mass, initial prototype cushions successfully met and exceeded this requirement. When dynamically evaluated by human subjects in moderate wave action, these prototypes failed in 8 minutes. Progressive development has resulted in a number of seat-cushion designs utilizing a variety of techniques to provide adequate survivor flotation. Prototypes of these seat cushions were subjected to dynamic and more realistic evaluation by human subjects both in the field and laboratoy. A comparison of mechanical- and human-subject evaluations is included. Survivor body-flotation attitude and seat-cushion retention devices are also discussed. Author

N67-13006# Technology, Inc., Dayton, Ohio.

A SURVEY OF TURBULENCE AND OTHER DATA AVAILABLE IN THE NATO COUNTRIES

Cyril G. Peckham Apr. 1966 62 p refs Prepared for AGARD

As atmospheric turbulence environment is one of the primary problem areas in military aircraft structure design, available data on turbulence, flight loads, commercial surveys, ground loads, sinking speeds, and runway profiles were surveyed. The major portion of the data was collected with instruments that record airspeed, altitude, and acceleration at the center of gravity plus elapsed time from takeoff; although the instruments used in the various countries differ, the pertinent information is the same. The use of the discrete gust and the continuous turbulence concepts are discussed in relation to establishing the required spectra for both approaches. All data are reported by the individual countries: Canada, Germany, Italy, France, United Kingdom, and the United States. M.G.J.

N67-13030# General Electric Co., Cincinnati, Ohio. Advanced Engine and Technology Dept.

XV-5A LIFT FAN FLIGHT RESEARCH AIRCRAFT: PHASE I FLIGHT TEST RESULTS, VOLUME I

Mar. 1966 191 p refs

(Contract DA-44-177-TC-715)

(Rept.-166, Vol. I; AD-639231) CFSTI: HC $6.00/MF $1.25

The U.S. Army XV-5A satisfactorily completed an extensive flight test program consisting of investigations of the hovering, transition and conventional flight regimes. A total of 45 flight hours were accomplished during which 53 vertical take-offs, 72 conventional take-offs, 17 fan flight mode take-offs at forward speed, and 74 conversions between fan and conventional flight modes were performed. Original flight test objectives were systematically accomplished in successfully demonstrating the feasibility of the lift fan concept of flight. Author (TAB)

N67-13031# General Electric Co., Cincinnati, Ohio. Advanced Engine and Technology Dept.

XV-5A LIFT FAN FLIGHT RESEARCH AIRCRAFT: PHASE I FLIGHT TEST RESULTS, VOLUME II

Mar. 1966 215 p refs

(Contract DA-44-177-TC-715)

(Rept.-166, Vol. II; AD-639232) CFSTI: HC $6.00/MF $1.25

Conventional flight test results (performance, stability and control, thermodynamics); aircraft systems (hydraulic, electrical, propulsion system history, XV-5A landing gear, airspeed system); strucures and loads. TAB

N67-13034# General Electric Co., Cincinnati, Ohio. Advanced Engine and Technology Dept.

XV-5A FLIGHT RESEARCH AIRCRAFT PROGRAM: FINAL SYSTEMS ANALYSIS AND FLIGHT SIMULATION REPORT, VOLUME II

Mar. 1965 121 p refs

(Contract DA-44-177-TC-715)

(Rept.-157, Vol. II; AD-639230) CFSTI: HC $4.00/MF $1.25

Stability augmentation (SA) system gains were optimized by piloted flight simulator evaluation of hovering under gusty wind conditions. While operation of the SA system poses no problems during transition, stability augmentation is unnecessary above 40 knots IAS. For the 2,500 ft. hot day conditions simulated, the rapidity with which a constant altitude transition from hovering could be accomplished was limited by power available and, at the more aft c.g. locations when using a nose fan thrust reversal capability of 30%, by longitudinal trim capability. An automatic horizontal trim feature has been selected for transition which programs the tail to the full 20 degree incidence limit at all louver vector angles of 40 degrees or less. Conversion between conventional and fan flight modes is accomplished by timed sequencing of the wing fan door opening and horizontal tail incidence change as a function of diverter valve motion. Failure studies have shown that uncommanded tail motion could result in a dangerous flight condition. Author (TAB)

N67-13058# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.

FLIGHT EVALUATION OF A STABILITY AUGMENTATION SYSTEM FOR LIGHT AIRPLANES Final Report

Franklin F. Eckhart, G. Warren Hall and Paul A. Martino Nov. 1966 149 p refs

(Contract FA-66-WA-1456)

(FAA-ADS-83; IH-2154-F-1)

Twenty-six noninstrument rated private and commercial pilots, whose distribution by rating and flight hours was typical of those who are involved in IFR disorientation accidents, and five instrument rated commercial pilots were flown. Quantitative measures of the bank angle, airspeed, altitude and heading were recorded during a series of planned VFR and IFR tasks with the SAS on and off. Qualitative data were obtained from the subject pilots by questionnaire and the recorded observations of the safety pilot. A statistical analysis was made of the differences in pilot performance during system on and system off operations. It was shown that the stabilizing effects of SAS, although not sufficient in itself to prevent this type of accident, significantly improved the noninstrument rated pilot's ability to maintain control of the airplane during an inadvertent encounter with IFR conditions. Author

N67-13145# Aeronautical Research Labs., Melbourne (Australia).
GUST MANOEUVRE SPECTRA ON THE EMPENNAGE OF THE WINJEEL TRAINER AIRCRAFT
J. M. H. Barnard, G. P. Bruce, and S. Gee Apr. 1966 22 p refs
(ARL/SM-296) CFSTI HC$1.00/MF$0.50

Flight tests have been performed on a Winjeel trainer aircraft to provide data for life calculations and possible fatigue tests on the fin, tailplane, and rear fuselage. Strains have been measured at suitable points on the empennage during symmetric and asymmetric maneuvers particularly during stable spins and spiral dives. Ground calibrations have been used to indicate the absolute values of strain in flight, and from available data on aircraft utilization, theoretical gust and maneuver spectra have been deduced for the tailplane, fin, and rear fuselage. Author

N67-13178*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF AFT-FUSELAGE-MOUNTED NACELLES ON THE SUBSONIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A TWIN-TURBOJET AIRPLANE
Lawrence E. Putnam and Charles D. Trescot, Jr. Washington, NASA, Dec. 1966 56 p refs
(NASA-TN-D-3781) CFSTI: HC$2.50/MF$0.50 CSCL 01C

An investigation has been made in a 26-inch transonic blowdown tunnel to determine the effects of aft-fuselage-mounted nacelles on the aerodynamic characteristics of a twin-turbojet airplane. The tests were made over a Mach number range from 0.63 to 0.82, at Reynolds numbers (based on wing mean aerodynamic chord) from 2.79×10^6 to 3.94×10^6, and at angles of attack from $-2°$ to $6°$. The investigation was undertaken primarily to determine the effects of nacelle incidence, nacelle longitudinal location, nacelle cant angle, and modifications to the local area distribution on the lift, drag, and pitching-moment characteristics of the airplane configuration. Some tests were also made in the low-turbulence pressure tunnel at a Mach number of about 0.2 to determine the effects of varying the Reynolds number from 1.36×10^6 to 2.52×10^6 on the high-angle-of-attack (up to 45°) stability characteristics of the configuration. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N67-12757*# Pratt and Whitney Aircraft, East Hartford, Conn.
STEADY-STATE AND DYNAMIC OPERATING CHARACTERISTICS OF A SIMULATED THREE-LOOP SPACE RANKINE-CYCLE POWERPLANT Summary Report, 15 May 1964–1 May 1965
J. R. Hooper Washington, NASA, Nov. 1966 146 p refs
(Contract NAS3-2335)
(NASA-CR-625) CFSTI: HC$3.00/MF$1.00 CSCL 10B

Experimental investigations were conducted with a facility which simulated heat transfer and fluid flow in a Rankine-cycle space power-conversion system of the SNAP 8 type. Water was used as the working fluid. Steady-state condenser and boiler data are presented in a form suitable to a linearized analysis of the interactions of these components with the rest of the system. Frequency response data was obtained by varying the power-loop flow rate at the boiler inlet. Experimental stability maps are presented as a function of the pressure-flow slope imposed at the boiler inlet. Author

N67-12903*# Thermo Electron Engineering Corp., Waltham, Mass.
SOLAR THERMIONIC GENERATOR DEVELOPMENT Second Quarterly Report, Mar. 1–Jun. 1, 1966
Jun. 1966 28 p Prepared for JPL
(Contract NAS7-100)
(NASA-CR-80200; TE-91-66) CFSTI: HC $2.00/MF $0.50 CSCL 10B

During the period, the second engineering model, T-202, was tested, and two unsuccessful attempts at the fabrication of the third, T-203, were made. Test results on T-202 indicated that the interelectrode spacing of converter T-202 is less uniform than that of converter T-201 and has a larger average value. Consequently, the performance of converter T-202 was lower in the unignited mode, and higher in the ignited mode than the performance of converter T-201. The attempts to fabricate T-203 failed because a more stringent revised outgassing procedure was applied in which the collector temperature during outgassing was brought up to 800°C rather than 700°C. The higher temperature appears to have caused the failure of the same braze in both instances. A new attempt is now in progress to fabricate T-203. Author

N67-12906*# Electro-Optical Systems, Inc., Pasadena, Calif.
HYDROGEN–OXYGEN ELECTROLYTIC REGENERATIVE FUEL CELLS, 1 JULY–1 AUGUST 1966
Martin G. Klein 10 Aug. 1966 20 p
(Contract NAS3-2781)
(NASA-CR-80109; EOS-4110-ML-27) CFSTI: HC $1.00/MF $0.50 CSCL 10A

This report reviews the progress made on the development of a hydrogen–oxygen regenerative fuel cell (secondary battery). During this period primary emphasis was placed on the testing of single cells with various electrode matrix structures in order to improve cycle life performance. Single cells tested employed variations of potassium titanate matrices to optimize fabrication techniques and to obtain performance parameters and an understanding of modes of deterioration that exist within cycling cells. The titanate matrices have continually demonstrated superior performance over what has previously been obtained, and the limit of their capability has not yet been determined. Author

N67-12939*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
PERFORMANCE OF JPL TUBULAR THERMOELECTRIC MODULE (TEST ASSEMBLY 909 E687)
15 Jul. 1966 31 p Prepared for JPL
(Contracts NAS7-100; CU-388002)
(NASA-CR-80188; WANL-TME-1467) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Room temperature characteristics and elevated temperature testing are reported for a tubular thermoelectric module. Resistance measurements at room temperature are tabulated at various stages during instrumentation of the module. High temperature testing is described with respect to measurement methods, startup, lifetime, and thermal cycling. S.P.

N67-12963*# Bureau of Mines, Pittsburgh, Pa. Coal Research Center.
DEVELOPMENT OF AN IMPROVED OXYGEN ELECTRODE FOR USE IN ALKALINE H_2–O_2 FUEL CELLS Quarterly Report, 1 Jul.–30 Sep. 1966
D. Bienstock, R. C. Diehl, and C. T. Grein 30 Sep. 31 p refs
(NASA Order W-12300)
(NASA-CR-80345; Q-1) CFSTI HC $2.00/MF $0.50 CSCL 10A

An apparatus was built for preparing catalysts for use as the oxygen electrode in the alkaline H_2–O_2 fuel cell. It consists of four units which can be operated independently to reduce, carbide, or nitride 50 to 100 cc batches of catalyst preparations. Samples submitted for fuel-cell testing include epsilon, chi, and theta iron carbides, gamma, epsilon, and zeta iron nitrides, iron carbonitrides, and iron nitrocarbides prepared from leached Raney iron and from a reduced alkali-promoted magnetite. An induction furnace has been modified to accommodate preparations of 1-pound batches of Raney alloys under an inert atmosphere or under vacuum. Author

N67-12969*# Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.
SMALL FUEL CELL TO ELIMINATE PRESSURE CAUSED BY GASSING IN HIGH ENERGY DENSITY BATTERIES Final Report, 30 Jun. 1965–30 Jun. 1966
H. Frank and M. P. Strier 30 Jun. 1966 81 p refs
(Contract NAS5-9594)
(NASA-CR-80339; SM-48457-F) CFSTI: HC $3.00/MF $0.75 CSCL 10A

Miniature hydrogen-oxygen fuel cells were installed in silver–zinc batteries to consume evolving gases, thereby relieving pressure and preventing rupture of the battery cases. Experiments and tests were conducted with previously devised miniature cells in both simulated and actual battery gassing environments. Included were life tests in battery simulators, determination of the effects of temperature and gas composition on performance, and evaluation of water removal techniques. Performance tests were conducted in 100-amp-hour silver–zinc cells. The fuel cells delivered electrical energy that may be used for an auditory warning or telemetering response indicating battery gassing. It was demonstrated that miniature fuel cells can be used successfully to relieve the pressure buildup in commercial silver–zinc cells. K.W.

N67-12970*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
NIMBUS-B SOLAR-CONVERSION POWER SUPPLY SUBSYSTEM Quarterly Technical Report, Jun.–Aug. 1966
17 Oct. 1966 86 p
(Contract NAS5-9668)
(NASA-CR-80338; AED-R-3076; QTR-4) CFSTI: HC $3.00/MF $0.75 CSCL 10B

Reported are power subsystem operations with six storage modules, battery discharge current telemetry range compatibility studies, and studies of the radioisotope thermoelectric generator radiation effects on solar array. An engineering model of the control module, two fuse boards, and two printed-circuit boards were modified, and breadboard tests were performed. Work in the development of the storage module included analysis of storage cell performance data, a parametric study of Nimbus-type storage cells, a weight analysis, vibration tests, and modification of the battery disconnect circuit. Progress in the work on module and subsystem test units is briefly mentioned. Engineering reliability activities that are covered include parts selection, application, and control; reliability predictions; failure mode categorization; and criticality analyses. K.W.

N67-13017*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DESIGN ANALYSIS OF JPL TUBULAR THERMOELECTRIC MODULE (909;E686G01)
15 Jul. 1966 40 p refs Prepared for JPL
(Contracts NAS7-100; JPL-CU-388002)
(NASA-CR-80198; WANL-TME-1438) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Details are given on the design concept and general characteristics of the tubular thermoelectric module which is considered to be well adapted for use in a two-loop liquid metal system. Structural, thermal, and thermoelectric analyses were performed to determine the design parameters; however, as the analytical techniques used are still being developed, it is pointed out that the analyses described represent only the state-of-the-art understanding of module behavior. Assembly and processing steps are discussed, and component and total weight of the test assembly are listed. Recommended procedures for the start-up, shutdown, matched load, and open circuit operating modes are presented. Shock and vibration capability test data are also given. M.G.J.

N67-13133*# Gulton Industries, Inc., Metuchen, N. J. Alkaline Battery Div.
CHARACTERIZATION OF RECOMBINATION Quarterly Report, Jun. 9–Sep. 9, 1966
S. Lerner 9 Sep. 1966 20 p
(Contract NAS5-10241)
(NASA-CR-80480; QR-1) CFSTI: HC $1.00/MF $0.50 CSCL 10A

A rapid method for determining the oxygen recombination ability of scavenger electrodes (both the Adhydrode and fuel cell types) has been devised. Two types of fuel cell electrodes and Adhydrodes in various thicknesses and porosities have been studied. The best recombination achieved for the Adhydrode has been on an electrode 0.055" thick and of 85% porosity. However, since the adhesion of the active material to the substrate is poor, the next best material, 0.020" thick and 70% porous, was chosen as the Adhydrode to be further studied in test cells. The AB-6X fuel cell electrode is shown to have an oxygen recombination rate about 10 times greater than the best Adhydrode material. Author

N67-13186*# Bendix Corp., Southfield, Mich. Research Labs. Div.
DESIGN, FABRICATION AND TEST OF A FLUERIC SERVOVALVE Quarterly Report, 28 Mar.–28 Jun. 1966
C. E. Vos 28 Jun. 1966 36 p
(Contract NAS3-7980)
(NASA-CR-72102; BRLD-3642) CFSTI: HC $2.00/MF $0.50 CSCL 13G

Development tests were performed on a breadboard model of a pneumatic-input flueric servovalve, which operates with no moving parts. The servovalve is designed to operate with H_2 at temperatures from 56°K (100°R) to 333°K (600°R), supply pressure of 148 N/cm^2 (215 psia), exhaust pressure of 34.5 N/cm^2 (50 psia), and maximum control pressure of 48.5 N/cm^2 (70.4 psia). Tests were performed on the power stage vortex pressure amplifier to improve the stability. As an alternative to the vortex pressure amplifier, a vortex bridge type of power stage was also tested. All tests for this period were performed using nitrogen. This report presents the results of tests performed during the fourth three-month period of the program. Author

N67-13203*# Westinghouse Electric Corp., Pittsburgh, Pa.
JET PROPULSION LABORATORY POWER SUPPLY SYNCHRONIZER Final Report
19 Sep. 1966 35 p Prepared for JPL
(Contracts NAS7-100; JPL-950237)
(NASA-CR-80538) CFSTI: HC $2.00/MF $0.50 CSCL 10B

The feasibility of fabricating a power supply synchronizer subsystem on a minimum number of chips and in a single package is demonstrated. The logic design is described, and requirements of the materials and processes involved in fabricating a no cap, multilayer interconnected device are considered. Problems encountered in the design and fabrication of nonlinear load switches are also discussed. A.G.O.

N67-13208*# TRW Systems, Redondo Beach, Calif.
POWER SYSTEM CONFIGURATION STUDY AND RELIABILITY ANALYSIS Quarterly Progress Report, 7 Jul.–7 Oct. 1966
W. G. Binckley 4 Nov. 1966 29 p Prepared for JPL
(Contracts NAS7-100; JPL-951574)
(NASA-CR-80533; E-7061.2-282; QPR-1) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Model spacecraft configurations and sets of power requirements were determined for five interplanetary missions, namely, 0.3 AU and 5.2 AU probes, and Venus, Mars and Jupiter orbiters. Mission profiles and power profiles were defined for each configuration. Representative solar array current-voltage output characteristics were calculated for each mission. Analyses of optimized photovoltaic power system configurations based on maximum reliability and minimum weight were initiated. Candidate baseline (non-redundant) power system configurations were determined for each model spacecraft. These configurations are characterized by different regulation and control techniques to integrate the solar array and battery, and supply regulated outputs. The various investigations are summarized and examples of the results are provided. Author

N67-13209*# Electro-Optical Systems, Inc., Pasadena, Calif.
HIGH-PERFORMANCE THERMIONIC CONVERTERS Final Report, 19 May 1965–19 Jul. 1966
A. E. Campbell 2 Sep. 1966 180 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951225)
(NASA-CR-80532; EOS-6952-Final) CFSTI: HC $5.00/MF $1.00 CSCL 10A

The construction of the precision, variable parameter, test vehicles to investigate plane parallel, cesium vapor converter performance characteristics, and the fabrication and testing of the high performance thermionic converters are reported. The electrode materials selection and secondary experiments supporting converter technology are outlined, and the converter design and performance are described in detail. Test vehicles were made with rhenium emitter/rhenium collector, and with rhenium emitter/molybdenum collector. The converter performance of 20 watts/cm^2 power output at 0.8 volts for an emitter temperature of 1735°C was obtained. Procedures in the fabrication technology are included. N.E.N.

N67-13211*# Monsanto Research Corp., Everett, Mass.
SEPARATOR DEVELOPMENT FOR A HEAT STERILIZABLE BATTERY Quarterly Summary Progress Report No. 1, 1 May–31 Aug. 1966
John J. O'Connell and Elizabeth A. Mc Elhill 31 Aug. 1966 33 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951524)
(NASA-CR-80530; MRB6234Q1) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Several ligand-containing vinyl polymer systems were selected for evaluation as battery separator materials that would be usable in heat sterilizable Ag–Zn batteries. These ligand polymers are prepared by two general procedures: (1) copolymerization of vinyl ligand monomers to form polymers having bidentate chelate functionality, and (2) direct substitution of ligand groups on a preexisting polymer backbone. Tested for stability, several types have shown high resistance to degradation by 40% KOH at 135°C after 60 hours exposure. The most promising materials were copolymers of 2-vinylpyridine with either acrylic or methacrylic acid, and polymers containing ligand groups substituted on a polystyrene backbone through a methylene group. Initial tests indicate that membranes prepared by the *in situ* saponification of 2-vinylpyridine–methyl acrylate copolymers have both acceptable electrical resistances (≈100 ohm-cm) and usable mechanical toughness. Author

N67-13212*# Westinghouse Electric Corp., Pittsburgh, Pa.
SEPARATOR DEVELOPMENT FOR A HEAT STERILIZABLE BATTERY Quarterly Report, 1 Jun.–30 Sep. 1966
A. Langer, R. G. Charles, and C. R. Ruffing 30 Sep. 1966 30 p ref Prepared for JPL
(Contracts NAS7-100; JPL-951525)
(NASA-CR-80529; Rept.-66-1B6-BSEPA-R1; QR-1) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Two approaches are being pursued in attempts to produce separators for silver-zinc cells that must be subjected to sterilization heat treatment. The major effort is on preparation and characterization of composite separators, containing inorganic materials within a porous matrix of organic material. Several filler and matrix materials have been identified as promising components by screening tests of many candidate materials for KOH resistance. Experimental composites have been prepared by impregnation. These are being characterized by measurement of electrolytic conductivity, electrolyte diffusion rate, silver and zinc diffusion rates, resistance to dendrite penetration, and mechanical measurements. Instruments are described for carrying out the conductivity and diffusion rate measurements. The results are not yet conclusive; however, it appears that conductivity requirements of battery separators are initially met or exceeded by several of the experimental composites. Additional measurements are required after subjecting the separators to heat cycles. Author

N67-13214*# Electro-Optical Systems, Inc., Pasadena, Calif.
HYDROGEN–OXYGEN ELECTROLYTIC REGENERATIVE FUEL CELLS, 1 AUGUST–1 SEPTEMBER 1966
Martin G. Klein 10 Sep. 1966 17 p
(Contract NAS3-2781)
(NASA-CR-80527; EOS-4110-ML-28) CFSTI: HC $1.00/MF $0.50 CSCL 10A

During this reporting period, primary emphasis was placed on the testing of single cells with various electrode matrix structures in order to improve cycle life performance. Single cells tested employed variations of potassium titanate matrices to optimize fabrication techniques and to obtain performance parameters and an understanding of modes of deterioration that exist within cycling cells. Author

N67-13215*# Varian Associates, San Carlos, Calif. Eimac Div.
DEVELOPMENT AND FABRICATION OF A 150–800 MHz 1kW CW POWER SOURCE Quarterly Progress Report, 21 Jun.–30 Sep. 1966
Edward S. Hensperger 30 Sep. 1966 40 p Prepared for JPL
(Contract NAS7-100)
(NASA-CR-80526; QPR-1) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Progress is reported from a study to develop and fabricate a selfcontained laboratory power source which provides a minimum output of 1kW CW over the continuously tunable frequency range of 150 to 800 MHz. The main effort was concentrated on planning the overall packaging of the system to fit the required space available, and planning an orderly and efficient program to achieve project objectives. A general description of the system is given and several block diagrams are included. A.G.O.

N67-13216*# Thermo Electron Engineering Corp., Waltham, Mass.
THERMIONIC RESEARCH PROGRAM Final Report, Jun. 1965–Jun. 1966

S. Kitrilakis, D. Lieb, F. Rufeh, and L. Van Someren Aug. 1966 264 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951262)
(NASA-CR-80525; TE-12-67) CFSTI: HC $5.00/MF $1.25 CSCL 10A

Results are presented from experimental research in thermionic energy conversion. Consideration is given to the use of CsF vapor in addition to metallic cesium in converters and to the effects of inert gases on converter characteristics. The test converter, associated equipment, and experimental techniques are discussed, and metallurgical data on the preparation and definition of the emitter surfaces employed are given. Filament-type metal ceramic tubes that were constructed to maintain, in operation, vacuums of the order of 10^{-10} torr are described, and results of parametric tasks conducted with an electroetched rhenium surface are related. An analysis of converter characteristics in the Boltzmann region is also included. A.G.O.

N67-13269# California Univ., Livermore. Lawrence Radiation Lab.
HIGH-TEMPERATURE TESTING AND EVALUATION OF GRAPHITE HELICAL-SCREW EXPANDERS AND COMPRESSORS
W. M. Wells, D. W. Hanner, J. L. Mc Elroy, and E. Robinson 8 Jul. 1966 10 p refs Presented at the 1st Nonconventional Energy Conversion Appl. Conf., Los Angeles, 26–28 Sep. 1966
(Contract W-7405-ENG-48)
(UCRL-14660, Rev. 1; CONF-660916-1) CFSTI: HC $1.00/MF $0.50

A graphite expander, utilizing intermeshing helical rotors and following concepts of Lysholm and the Svenska Rotor Maskiner firm, is proposed for potential use with inert gas Brayton cycles. Two demonstration assemblies were tested. Each assembly consisted of a graphite expander and an identical compressor. Each assembly was installed in an argon atmosphere furnace where the motor-driven compressor provided pressurized argon to drive the expander. The graphite-on-graphite sliding bearings used were adequate for demonstration purposes but probably not for application. Work is under way on graphite roller and gas bearings. In the first assembly the compressor failed catastrophically due to rotor dragging. This defect was corrected in the second assembly which ran for 274 hr at furnace temperatures between 2350 and 2730°F before voluntary shutdown. Expander inlet temperatures are estimated to have exceeded 2900°F. Speeds to 14,100 rpm in the compressor and efficiencies to 37% in the expander were achieved. Shaft power to the compressor exceeded 10 hp and from the expander approached 1 hp. Pressure ratios in excess of 1.5 were achieved. For space application, expander specific weights below 1 lb/electrical kw appear plausible. Author (NSA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N67-12356# Joint Publications Research Service, Washington, D. C.
CYCLIC PROCESSES IN THE BIOSPHERE CAUSED BY COSMIC FACTORS AND POSSIBILITIES FOR TAKING THEM INTO ACCOUNT IN PLANNING
P. V. Florenskiy *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 74–78 refs (See N67-12341 03-05) CFSTI: $4.00

Cyclic processes in the biosphere are discussed in relation to planning and economy, particularly in forecasting the relationship of demands and the possibility of obtaining products. The cosmic origin of these variations is discussed, and it is pointed out that by foreseeing the variations it would be possible to forecast such phenomena as the size of harvests, the height of the tides, and the activity of bathogenic organisms. These forecasts could be applied not only to agriculture, but also to industry and public health. L.E.W.

N67-12357# Joint Publications Research Service, Washington, D. C.
THE BIOELECTRICAL EFFECT OF THE LEAD OF GEOMAGNETIC DISTURBANCES
A. K. Podshibyakin, R. V. Smirnov, R. G. Ushva, N. P. Adamenko, and V. I. Shakhova *In its* Rept. on Soviet Res. in the field of Bionics 21 Nov. 1966 p 79–84 refs (See N67-12341 03-05) CFSTI: $4.00

The reactions of live organisms to geomagnetic disturbances and thunderstorms are discussed, and investigations and experiments is this field are summarized. From analysis of the data, it was concluded that almost all people react to geomagnetic disturbances: 20% reacted weakly and appeared insensitive, 60% were definitely sensitive, and 20% were highly sensitive. Some of the geomagnetic effects reported include increased accidents, emergencies, and catastrophies; more complication after operations, especially on the brain; smaller birth activity; and general lowering of the physiological indices of man. The idea is mentioned of using man as a self-predicting bionic system, i.e., using information about his own electric potentials for prognosis of shifts in the geophysical state and applying the information to his working in a man–machine complex. L.E.W.

N67-12390# Joint Publications Research Service, Washington, D.C.
VESTNIK OF THE USSR ACADEMY OF MEDICAL SCIENCES, VOLUME XXI, NO. 8, 1966
L. K. Khotsyanov et al 25 Nov. 1966 115 p refs Transl. into ENGLISH Vestn. Akad. Med. Nauk SSSR (Moscow), v. 21, no. 8, 1965 p 1–94
(JPRS-38808; TT-66-35232) CFSTI: $4.00

CONTENTS:

1. SOME PROBLEMS OF OCCUPATIONAL HEALTH IN THE LIGHT OF TECHNICAL PROGRESS IN INDUSTRY L. K. Khotsyanov p 1–6
2. ADAPTATION OF THE BODY TO TEMPERATURE FLUCTUATIONS G. Kh. Shakhbazyan and F. M. Shleyfman p 7–13 refs (See N67-12391 03-04)
3. IMPORTANCE OF SPECTROANALYSIS IN ASSESSING THE CHARACTERISTICS OF THE EFFECT OF LOCAL VIBRATIONS ON MAN I. K. Razumov, N. N. Malinskaya, and E. I. Denisov p 14–20 refs (See N67-12392 03-04)
4. EFFECT OF SMALL CONCENTRATIONS OF CARBON DISULFIDE ON CERTAIN FUNCTIONS AND ORGANS OF ANIMALS L. M. Kashin p 21–29 refs (See N67-12393 03-04)
5. ON THE NATURE OF THE CARDIOTOXIC EFFECTS OF MERCURY AND ORGANIC MERCURY COMPOUNDS I. M. Trakhtenberg, G. A. Goncharuk, and V. Ye. Balashov p 30–40 refs (See N67-12394 03-04)
6. PHYSIOLOGICAL ASSESSMENT OF ARTIFICIAL ILLUMINATION OF DIFFERENT SPECTRAL COMPOSITION Z. A. Skobareva p 41–46 refs (See N67-12395 03-04)
7. GENERAL IMMUNOLOGICAL REACTIVITY OF THE ORGANISM IN PROPHYLACTIC ULTRAVIOLET IRRADIATION OF CHILDREN IN NORTHERN REGIONS A. P. Zabaluyeva and B. I. Ioannesyan p 47–52 refs
8. CHANGES IN THE RESISTANCE OF TISSUES IN ANIMALS INHALING IONIZED AIR L. V. Serova p 53–60 refs
9. THE EFFECT OF COMBINED ACTION OF DIFFERENT TYPES OF RADIANT ENERGY ON THE BODY'S RESISTANCE TO IONIZING RADIATION N. F. Galanin, R. S. Mostova, T. A. Sviderskaya, and D. M. Tyukov p 61–68 refs (See N67-12396 03-04)

10. TOWARD ESTABLISHING A MAXIMALLY PERMISSIBLE CONCENTRATION OF NATURAL URANIUM IN THE WATER OF OPEN BASINS V. N. Gus'kova, A. N. Bragina, V. M. Kupriyanova, and N. I. Mashneva p 69–77 refs

11. ON THE POSSIBLE APPLICATION OF IMMUNOLOGICAL INVESTIGATIONS IN STANDARDIZATION OF RADIOACTIVE INTAKE (THE EFFECT OF INCORPORATED Sr^{90} ON THE PRODUCTION OF ANTIBODIES) M. A. Nevstruyeva, V. M. Shubik, and R. Ye. Livshits p 78–84 refs

12. THE PROBLEM OF HYGIENIC STANDARDIZATION OF LOW ENERGY X-RAYS A. N. Liberman p 85–90 refs

13. THE EFFECT PRODUCED BY PRELIMINARY EXPOSURE OF MICE TO X-RAYS IN A DOSE OF 25 r ON THE FREQUENCY OF CHROMOSOMAL REVISIONS FOLLOWING REPEAT IRRADIATION IN A DOSE OF 300 r R. I. Bikkulov and Yu. K. Kudritskiy p 91–95 refs

14. DOSIMETRIC CHARACTERISTICS OF WORKING CONDITIONS OF ROENTGENOLOGISTS R. V. Stavitskiy p 97–105 refs

15. BASIC TRENDS OF RESEARCH IN THE DOMAIN OF CHILD AND ADOLESCENT HYGIENE G. N. Serdyukovskaya p 106–113

16. ON THE DERANGED INITIAL ROUTES OF EXOGENOUS LIPID METABOLISM IN PATIENTS SUFFERING FROM OBESITY T. I. Loranskaya, V. A. Oleneva, and L. A. Savchuk p 114–119 refs

17. BOTKIN'S INFECTIOUS HEPATITIS (A SURVEY OF THE PROBLEM) V. M. Zhdanov, A. K. Shubladze, Ye. A. Paktoris, and V. A. Anan'yev p 120–130

18. ON THE IMPORTANCE OF SOIL TYPES AS A FACTOR AFFECTING THE HEALTH OF MAN V. M. Meshchenko p 131–134 refs

N67-12391# Joint Publications Research Service, Washington, D. C.

ADAPTATION OF THE BODY TO TEMPERATURE FLUCTUATIONS

G. Kh. Shakhbazyan and F. M. Shleyfman *In its* Vestn. of the USSR Acad. of Med. Sci. 25 Nov. 1966 p 7–13 refs (See N67-12390 03-04) CFSTI: $4.00

The problem of marked temperature changes and their effect on human and animal thermoregulatory mechanisms is considered. Adverse effects of body exposure to drastic temperature fluctuations are listed: modifications in the blood serum protein and amino acid–nitrogen concentration; upset protein-forming function of the liver; changes in blood sugar level, and in alkaline reserves; hemodynamic and vascular disturbances and, sometimes, dystrophic alterations in the brain and parenchymatous organs. The mobilization of the organism's defense faculties, and the decline of the thermal resistance in animals, revealed after application of functional loads of the thermoregulatory system, demonstrate that with sharp temperature fluctuations, adaptive forces fail to come into play. R.Ll.

N67-12392# Joint Publications Research Service, Washington D. C.

IMPORTANCE OF SPECTROANALYSIS ON ASSESSING THE CHARACTERISTICS OF THE EFFECT OF LOCAL VIBRATIONS ON MAN

I. K. Razumov, N. N. Malinskaya, and E. E. Denisov *In its* Vestn. of the USSR Acad. of Med. Sci. 25 Nov. 1966 p 14–20 refs (See N67-12390 03-04) CFSTI: $4.00

For industrial application of vibration pathology studies, both the high and low frequency vibrations of manually operated percussion and rotary tools were investigated. Vibragrams were assessed, and it is stated that the vibration spectra change in accordance with the work routine, the form and nature of the product being worked on, as well as the technical condition of the various tools. The use of vibration-protecting devices, consisting of an absorbing spring set between the handle and the body of the tool, is mentioned as a method of reducing adverse effects of vibration. R.Ll.

N67-12393# Joint Publications Research Service, Washington, D. C.

EFFECT OF SMALL CONCENTRATION OF CARBON DISULFIDE ON CERTAIN FUNCTIONS AND ORGANS OF ANIMALS

L. M. Kashin *In its* Vestn. of the USSR Acad. of Med. Sci. 25 Nov. 1966 p 21–29 refs (See N67-12390 03-04) CFSTI: $4.00

To improve industrial conditions for workers subject to carbon disulfide intoxication, experimental results of animal studies were assessed. It was found that carbon disulfide in concentrations of 100 and 100 mg/m^3 markedly suppresses the immunological responsiveness of the organism, and that the adrenal cortex function is suppressed. Less significant changes were noted in protein metabolism and blood morphology. It is stated that carbon disulfide produces manifest changes in the organism even at concentrations accepted as maximally permissible, and that consequently such permissible concentrations in the atmosphere of industrial areas must be reduced. R.Ll.

N67-12394 Joint Publications Research Service, Washington, D. C.

ON THE NATURE OF THE CARDIOTOXIC EFFECTS OF MERCURY AND ORGANIC MERCURY COMPOUNDS

I. M. Trakhtenberg, G. A. Goncharuk, and V. Ye. Balashov *In its* Vestn. of the USSR Acad. of Med. Sci. 25 Nov. 1966 p 30–40 refs (See N67-12390 03-04) CFSTI: $4.00

Animal study data analyses were reviewed to determine the cardiotoxic effect of organic mercury compounds, which are active agents in granosan, mercuran, and mercurhexane pesticides. Experimental data indicate that with prolonged toxic exposure, changes occurred in the circulatory function, and limit the capabilities of the cardiovascular system. Details are reviewed on the effect of mercury and its organic compounds on cardiac function, and the evolution of an acute coronary insufficiency against the background of mercury poisoning is described. The mechanism of cardiotoxic action is discussed from the viewpoint of disturbed extracardiac regulation and possible direct effect of the poison upon the myocardium. R.Ll.

N67-12395# Joint Publications Research Service, Washington, D.C.

PHYSIOLOGICAL ASSESSMENT OF ARTIFICIAL ILLUMINATION OF DIFFERENT SPECTRAL COMPOSITION

Z. A. Skobareva *In its* Vestn. of the USSR Acad. of Med. Sci. 25 Nov. 1966 p 41–46 refs (See N67-12390 03-04) CFSTI: $4.00

For industrial application purposes, the effectiveness of visual work under various types of artificial illumination is assessed. Physiological response to incandescent lamps, luminescent (fluorescent) lamps, and combinations of illuminating and erythemic luminescent lamps were reviewed. The dynamics (contrast and chromatic sensitivity of the eye) during strained visual work under experimental lighting was verified. To perform tasks not requiring color discrimination, luminescent lamps of the white light type, not below 300 lux intensity of illumination, were found most effective. It was also concluded that when ultraviolet radiation of erythemic lamps is combined with sufficient intensity of the luminous flux, the fluorescence of the eye media does not affect the visual function in man. R.Ll.

N67-12396# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF COMBINED ACTION OF DIFFERENT TYPES OF RADIANT ENERGY ON THE BODY'S RESISTANCE TO IONIZING RADIATION

N. F. Galanin, R. S. Mostova, T. A. Sviderskaya, and D. M. Tyukov *In its* Vestn. of the USSR Acad. of Med. Sci. 25 Nov. 1966 p 61–68 refs (See N67-12390 03-04) CFSTI: $4.00

To increase organism's protection against ionizing radiation, experimental analyses of ultraviolet and infrared radiation on body resistance are reviewed. Experiments on laboratory animals (mice, guinea pigs, and rabbits) indicated central nervous system, as well as immuno-biological, biochemical, and hematological reactions. R.Li.

N67-12441# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.

NUTRITIONAL REQUIREMENTS FOR SURVIVAL IN THE COLD AND AT ALTITUDE

Lucile Vaughan ed 1965 395 p refs Proc. of the 5th Symp. on Arctic Biol. and Med. Held in Fort Wainwright, Alaska, 22–24 Mar. 1965; Sponsored by Alaska Univ.

(AD-637887) CFSTI: HC $7.00/MF $1.75

CONTENTS:

1. NUTRITIONAL EFFECTS ON HUMAN PERFORMANCE IN THE COLD K. Rodahl and B. Issekutz, Jr. (Lankenau (Hospital) p 7–47 refs (See N67-12442 03-04)

2. WATER AND CALORIC REQUIREMENTS AS PREDICTED FROM ENVIRONMENTAL CONDITIONS AND PHYSICAL ACTIVITY E. R. Buskirk and L. L. Boyer, Jr. (Pa. State Univ.) p 49–83 refs (See N67-12443 03-04)

3. STUDIES ON PROTEIN METABOLISM IN HARD MUSCULAR WORK IN RELATION TO ITS NUTRITIONAL REQUIREMENT H. Yoshimura (Kyoto Univ.) p 85–120 refs (See N67-12444 03-04)

4. CARBOHYDRATE AND FAT METABOLISM DURING PROLONGED PHYSICAL WORK D. R. Young (NASA, Ames Res. Center) p 121–150 refs (See N67-12445 03-04)

5. BRITISH POLAR EXPEDITIONS—NUTRITIONAL DEVELOPMENTS AND RESEARCH H. E. Lewis (Natl. Inst. for Med. Res.) p 151–164 refs (See N67-12446 03-04)

6. ADAPTATION TO AUSTERE DIETS D. A. Vaughan (Aerospace Med. Div. Arctic Aeromedical Lab.) p 165–194 refs (See N67-12447 03-04)

7. MODIFICATION OF THE WOLFF INTEGRATING MOTOR PNEUMOTACHOGRAPH FOR ARCTIC USE J. C. Klopping (Stanford Univ.) p 195–208 refs (See N67-12448 03-05)

8. A THERAPEUTIC APPROACH TO ARCTIC SURVIVAL RATIONS J. Klopping (Stanford Univ.), T. A. Rogers, J. A. Setliff, and A. C. Buck (Hawaii Univ.) p 209–240 refs (See N67-12449 03-04)

9. SOME ENZYMATIC AND CARDIOVASCULAR EFFECTS OF STARVATION-REFEEDING STRESS B. C. Johnson (Ill. Univ.) p 251–297 refs (See N67-12450 03-04)

10. METABOLIC PROBLEMS OF HIGH ALTITUDE L. C. G. E. Pugh (Med. Res. Council) p 299–341 refs (See N67-12451 03-04)

11. NUTRITION AND FLUID BALANCE IN HIGH ALTITUDE MOUNTAINEERING T. O. Nevison, Jr., J. E. Roberts, and W. W. Lackey (Lovelace Foundation for Med. Education and Res.) p 343–363 refs (See N67-12452 03-04)

N67-12442# Lankenau Hospital, Philadelphia, Pa. Div. of Research.

NUTRITIONAL EFFECTS ON HUMAN PERFORMANCE IN THE COLD

Kaare Rodahl and Bela Issekutz, Jr. *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 7–47 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

A discussion is presented of the nutritional effects on human performance at normal room temperature, in clothed individuals habitually exposed to a cold environment, and in nude individuals exposed to extreme cold. Various experiments are cited, and graphs and tables are given which show performance, caloric intake, and oxygen intake as functions of time and temperature. C.T.C.

N67-12443# Pennsylvania State Univ., University Park. Dept. of Architectural Engineering.

WATER AND CALORIC REQUIREMENTS AS PREDICTED FROM ENVIRONMENTAL CONDITIONS AND PHYSICAL ACTIVITY

E. R. Buskirk and L. L. Boyer, Jr. *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 49–83 refs (See N67-12441 CFSTI: HC $7.00/MF $1.75

Specific mathematical and graphical expressions that describe man's requirements for water, oxygen, and food in any terrestrial environment are presented. The mathematical model consists of a 12-term polynomial equation wherein the requirement for water, oxygen, or food is the dependent variable, and activity level and thermal environment are two independent variables treated as single indices. A standard man is defined with respect to age, weight, sex, clothing, and acclimatization, so that influences of these variables would remain constant. Activity level is represented by body heat production, and the environment is defined in terms of a comfort mark rating. C.T.C.

N67-12444# Kyoto Univ. Japan. Dept. of Physiology.

STUDIES ON PROTEIN METABOLISM IN HARD MUSCULAR WORK IN RELATION TO ITS NUTRITIONAL REQUIREMENT

Hisato Yoshimura *In* Aerospace Med. Div. AAI Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 85–120 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

A lecture is presented on the mechanism of anemia which appears during the course of strenuous training. The destruction of erythrocytes in strenuous muscular exercise is explained as due to one of the stress reactions to heavy muscular work. Results from several experiments are shown to support this hypothesis. It was verified that the erythrocyte thus destroyed is utilized to promote the hypertrophy of skeletal and heart muscle and also the regeneration of new erythrocytes. The anemia due to the increased destruction of erhthrocytes can be prevented by providing a large amount of dietary protein, an amount sufficient to promote the erythrocyte regeneration covering its destruction. A discussion period following the lecture is also included. A.G.O.

N67-12445# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CARBOHYDRATE AND FAT METABOLISM DURING PROLONGED PHYSICAL WORK

Donald R. Young *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 121–150 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

A discussion is given of experiments and research efforts concerned with determining the requirements and composition of survival rations. In general it was found that experiments do not confirm the carbohydrate theory of fatigue. With dogs and human subjects, physical exhaustion was not conclusively related to the observed variations in blood sugar during treadmill tests. In the absence of a major limitation of water supply, a requirement for adequate carbohydrate nutrition appears to be more closely related to the prevention of ketosis than to the maintenance of the blood sugar level. However, since the ketosis of starvation is only transitory, it is likely that biological adaptations do occur which result in the improved utilization of fat. C.T.C.

N67-12446# National Inst. for Medical Research, London, (England). Div. of Human Physiology.

BRITISH POLAR EXPEDITIONS—NUTRITIONAL DEVELOPMENTS AND RESEARCH

Harold E. Lewis *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 151–164 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

A review is presented of work accomplishments in polar physiology, with emphasis placed on nutritional aspects. Various experiments are discussed in which measurements were made of such parameters as caloric intake, body temperatures, and physiological effects. C.T.C.

N67-12447# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.

ADAPTATION TO AUSTERE DIETS

David A. Vaughan *In its* Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 185–194 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

A discussion is presented of three experiments that have been conducted with respect to austere diets and survival rations of various kinds. The first experiment consisted of a simulated survival test of pemmican, a 3-ounce meat food bar which consists of dehydrated lean ground beef and pork bound together with beef fat. The second experiment was conducted to check earlier results and to test the effect of a larger supplement of sugar. The third experiment was designed to prove whether or not a difference in dietary composition during one episode of caloric restriction would have an affect on responses during a succeeding episode of caloric restriction. Results and conclusions of these experiments are given along with a discussion of various tables and graphs. C.T.C.

N67-12449# Hawaii Univ., Honolulu. Pacific Biomedical Research Center.

A THERAPEUTIC APPROACH TO ARCTIC SURVIVAL RATIONS

Terence A. Rogers, James A. Setliff, Alan C. Buck, and John Klopping (Stanford Univ) *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 209–249 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

The problems of an arctic survival situation arising from an aircraft emergency are considered under the main categories of clothing and shelter, starvation, and psychological stress. Experiments were directed toward studying the "clinical course" of a simulated survival situation, and to the possibility of minimizing the metabolic derangements in order to improve the physical performance of a survivor. C.T.C.

N67-12450# Illinois Univ., Urbana. Dept. of Animal Science.

SOME ENZYMATIC AND CARDIOVASCULAR EFFECTS OF STARVATION-REFEEDING STRESS

B. Connor Johnson *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and the Altitude 1965 p 251–297 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

Experimental studies are reported in (1) the cardiovascular effects of refeeding stress following long periods of starvation in swine and (2) the induction of certain enzymes of glucose metabolism by diet following starvation in rats. In the first area electrocardiograms from standard and augmented limb leads were recorded. Severe stresses upon the cardiovascular system were produced as a result of unrestricted initial refeeding, particularly with glucose alone or with a diet high in glucose. Histological damage of apparently irreversible nature was produced in the myocardium, arteries, and arterioles. Notable diastolic hypertension was evident after two starvation-refeeding episodes and persisted following the fourth episode. Using rats as the experimental animals, the enzymes glukokinase, isocitrate dehydrogenase, and glucose-6-phosphate dehydrogenase were assayed in the liver during various types of starvation and refeeding procedures. It was found that all three enzyme levels were depressed during either total or protein starvation. Upon refeeding a complete ration after total starvation, glucose-6-phosphate dehydrogenase increased to levels four to five times normal within 72-hours and then gradually return to normal. C.T.C.

N67-12451# Medical Research Council, London (England).

METABOLIC PROBLEMS OF HIGH ALTITUDE OPERATIONS

L. C. G. E. Pugh *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 299–341 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

Some of the problems of feeding men at high altitudes are discussed, with emphasis placed on results of Himalayan expeditions. It is shown that men at high altitudes need a lot of carbodydrate and they tolerate far more sugar than they can at sea level. It was found tha they have a reciprocal distaste for fats, and that the importance of adequate caloric and fluid intake should be rated at least as high as that of oxygen. C.T.C.

N67-12452# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

NUTRITION AND FLUID BALANCE IN HIGH ALTITUDE MOUNTAINEERING

Thomas O. Nevison, Jr. James E. Roberts, and William W. Lackey *In* Aerospace Med. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 343–363 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75

Nutrition and fluid requirements, two important aspects of high altitude mountaineering, are considered in view of their relationship to arctic survival. Measurements and findings of various expeditions are discussed and the results are given in tabular form. It is concluded that the best approach to very high altitude climbin is to minimize the stay at extreme altitudes, and to complete the climb before any major deterioration occurs as a result of combined hypoxia, exposure, near-starvation, and dehydration. An observed tendency for an increase in the rate of water exchange at altitude was found consistent with the known increase in respiratory water loss due to increased ventilation at altitude. The same danger exists in an arctic situation in which there are active subjects. C.T.C.

N67-12492# School of Aerospace Medicine, Brooks AFB, Tex.

PHYSIOLOGIC EFFECTS OF AN 18-HOUR FLIGHT IN F-4C AIRCRAFT

Edward F. Kramer, Jr., Henry B. Hale, and Edgar W. Williams Jun. 1966 15 p refs

(SAM-TR-66-59; AD-636911) CFSTI: HC $1.00/MF $0.50

Physiologic assessment was performed by means of postflight urinalysis for 8 pilots who flew F-4C aircraft for 18 hours. Flight effects were neither numerous nor of largemagnitude, nor were the pilots unduly fatigued. The flight-induced, physiologic changes included: (1) increased 17-hydroxycorticosteroid excretion, which implies adrenocortical stimulation, and (2) decreased excretion of uric acid, potassium, and irine, which suggests metabolic depression. Author

N67-12531# University Coll., Galway (Ireland). Dept. of Biochemistry.

BILIPROTEINS OF ALGAE

Colm Oheocha Repr. from Ann. Rev. Plant Physiol., v. 16, 1965 p 415–434 refs

(Grant AF-EOAR-63-18)

(AFOSR-66-1127; AD-637623)

Recent advances in biliprotein chemistry are reviewed. Topics include: Phycoerythrins, Phycocyanins, Phycobilins, Chemical Composition, Phycobilin–protein interactions. Author (TAB)

N67-12721# National Academy of Sciences–National Research Council, Washington, D. C.

EXTRATERRESTRIAL LIFE: AN ANTHOLOGY AND BIBLIOGRAPHY

Elie A. Shneour (Utah Univ.) and Eric A. Ottesen, comp. 1966 497 p refs

(NAS-NRC-1296A) Available from NAS-NRC, Washington, D. C.: $6.00

Articles and bibliography on the origins and evolution of terrestrial and extraterrestrial life and on Mariner IV and sounding rocket observations of Mars are presented. For individual titles see N67-12722–N67-12756.

N67-12722# Carnegie Institution of Washington, D. C.

GEOCHEMISTRY OF ORGANIC SUBSTANCES

Philip H. Abelson *In* NAS-NRC Extraterrest. Life 1966 p 3–28 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Some occurrences of organic substances in nature, their fate in geologic environments, and their thermal stability and reaction with other molecules are discussed. Temperature-time curves are plotted to show degradation of straight-chain hydrocarbons and porphyrins, as well as the oxidation of organic substances by oxygen in ground water. A comparison is made of recent and an Oligocene mud, and the principal amino acids in recent and Oligocene sediments are tabulated. Amino acids in fossils are discussed; and tables show their content in recent tropical calcium carbonate shells, and contents in various fossils from different geographical areas. Some hydrocarbons isolated from gas-oil fractions of Ordovician crude are tabulated; lipides, carbohydrates, and poryphyrins in geological environments are considered; and Precambrian occurrences are discussed. M.W.R.

N67-12723# Chicago Univ., Ill.

OBSERVATIONS ON THE NATURE OF THE "ORGANIZED ELEMENTS" IN CARBONACEOUS CHONDRITES

Frank W. Fitch and Edward Anders *In* NAS-NRC Extraterrest. Life 1966 p 29–47 refs Sponsored in part by AEC Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

On the basis of a previous tabulation of the organized elements in Class I carbonaceous chondrites, a study was made to confirm and further characterize the composition of such elements. Samples of the carbonaceous chondrites, Orgueil and Ivuna, were examined by conventional brightfield, phase contrast, and fluorescence microscopy; as well as by biological staining, X-ray diffraction, and electron microprobe analysis. Microscopic observations, fluorescence in ultraviolet light, biological stains, treatment with hydrofluoric acid are discussed; as are the attempts at identification, with special attention to organized elements embedded in mineral veins in thin sections. Differences between Claus and Nagy and the present authors are mentioned, and it is concluded that the present evidence is inadequate to suggest a biological origin for the indigenous particles. Some of the features which make it difficult to accept the highly structured particles as extraterrestrial in origin are their absence in the thin sections of the chondrites and their morphological resemblance to common airborne contaminants. M.W.R.

N67-12724# Miami Univ., Coral Gables, Fla. Inst. of Molecular Evolution.

HOW DID LIFE BEGIN?

Sidney W. Fox *In* NAS-NRC Extraterrest. Life 1966 p 48–64 refs Reprinted *Its* Fla. State Univ. Oceanog. Inst. Contrib. No. 130 (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

(Grants NSF G-4566; NIH C-3971)

Amino acid and proteinoid production are discussed in relation to the beginnings of life, and it is noted that there are proteins which possess all the properties of protenoids, with the exception of the nonantigenicity. Due to variation in proteins, exact comparisons present some difficulties. Several laboratories are concerned with evidence in which isolated chemical aspects of life might have arisen spontaneously. One experimental program and theory, predominantly thermal, has connected parts of each of the five stages of prelife in a continuum that proposes many living phenomena as inexorable consequences of preceding phenomena. Based largely on thermal experiments, a postulated first cycle leading to life, its reproduction, and mutation is diagrammed. Inferences which follow are (1) spontaneous generation of biochemical pathways, including production of amino acids and nucleic acid intermediates, (2) origin of protein in intimate relationship in the same reaction mixtures, and (3) spontaneous separation into prelliving units and environment when the system became aqueous. Viruses and unified outline theories are discussed, with some attention to the germ theory of the origin of life. M.W.R.

N67-12725# California Univ., Berkeley.

REDUCTION OF CARBON DIOXIDE IN AQUEOUS SOLUTION BY IONIZING RADIATION

W. M. Garrison, D. C. Morrison, J. G. Hamilton, A. A. Benson, and Melvin Calvin *In* NAS-NRC Extraterrest. Life 1966 p 65–69 refs Reprinted Sponsored by AEC (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Consideration is given to the origin of an organic milieu in the absence of any life at all. One source of reduced carbon compounds in complex arrangements might have been the interaction of various high energy radiations with aqueous solutions of inorganic materials. There are conditions under which these ionizing radiations could induce carbon dioxide reduction with water; resulting in the ultimate creation of polyatomic molecules, other than simple polymerication of monomers of carbon, oxygen, hydrogen, and nitrogen. Results are summarized for data obtained by the bombardment of air-free aqueous solution of C^{14}-labeled CO_2 in a closed system with and without ferrous sulfate. These indicate that appreciable quantities of carbon dioxide can be reduced to formic acid; but whether the formic acid is further reduced to formaldehyde or whether the formaldehyde arises during the reduction has yet to be determined. The actual ion-pair yield is not optimal; and, presumably, reduction is achieved via the secondary hydrogen atoms resulting from the ionization. M.W.R.

N67-12726# Indian Statistical Inst., Calcutta.

THE ORIGINS OF LIFE

J. B. S. Haldane *In* NAS-NRC Extraterrest. Life 1966 p 70–80 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

The problem of describing the origin of life is considered akin to the origin itself in that a number of attempts were made and almost all of them did not work. Natural selection eliminated many of the attempts with regard to the actual origin, and present-day speculations about the origins have the advantages of the "mistakes" of the many theories that have already been advanced. In summary, it is hypothesized that metastable organic compounds were formed by the action of solar radiation on the atmosphere before it contained much free oxygen. Catalytically active molecules, possibly like adenosinetriphosphoric acid, could increase their own number while breaking down the new organic compounds that came into being. The critical event that may be best called the origin of life was the enclosure of several different self-producing polymers with a semipermeable membrane. The origin of photosynthesis, anaerobic life, lifelike molecules, and othe aspects of the evolution of living matter are treated. M.W.R.

N67-12728# California Inst. of Tech., Pasadena.

ON THE EVOLUTION OF BIOCHEMICAL SYNTHESES

Norman H. Horowitz *In* NAS-NRC Extraterrest. Life 1966 p 82–86 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

A hypothesis suggests that the first living entity was a completely heterotropic unit that could reproduce at the expense

of prefabricated organic molecules in its environment. When the supply of specific substrates limited further multiplication, a mutation-type process utilized other available substances. Further evolution probably occurred through the chance combination of certain genes, and short reaction chains were developed which utilized substances that had previously been synthesized. It is noted that there are presently seven different genes concerned with the synthesis of arginine; and the inactivation of any one of these prevents synthesis. Two of the intermediates in the chain are identified as amino acids, ornithine and citrulline. Unlike arginine, neither of these is a general constituent of proteins; and, aside from their function as precursors, they are apparently of no further use to the organism. A model proves a means for the evolution of a new gene combination despite unfavorable mutation rates to active alleles. M.W.R.

N67-12729# Northwestern Univ., Evanston, Ill. Dearborn Observatory.

OCCURRENCE OF LIFE IN THE UNIVERSE

Su-Shu Huang *In* NAS-NRC Extraterrest. Life 1966 p 87–93 refs Reprintad (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Knowledge of stars and their evolution is used to discuss the requirements for life, especially in an advanced form. Time-scales of biological and stellar evolution are discussed, along with the habitable zone of a star and the dynamical and physical considerations which might hinder the development of life. Dynamically, a planet around one component of a binary or multiple system is always perturbed by its companions; and its chances of remaining within a habitable zone are greatly reduced. Further, if either component of a close binary system is of an early type, no life can be expected. The question is posed as to whether the orbit of a star around the galactic center has any bearing on the life-supporting property of its planets. The exact percentage of stars that actually support life is considered to depend upon the mode of star and planet formation; and, therefore, cannot be estimated objectively. It is concluded that there are no expectations of any well-evolved life on any of the planets of alpha Centauri. M.W.R.

N67-12730# Joint Publications Research Service, Washington, D. C.

OUTER SPACE AND LIFE

A. A. Imshenetsky *In* NAS-NRC Extraterrest. Life 1966 p 94–101 refs Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), v. 33, 1963 p 23–29 Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00 (JPRS-22015; TT-63-41224)

Microbiological analysis of meteorites, detection of life at high altitudes, and life on other planets and outer space are discussed in terms of designing possible experiments. The search for microorganisms on other planets should be in three phases: (1) Detection of heterotrophic bacteria by establishing conditions whereby large numbers of species can reproduce by using organic matter. (2) Search for chemoautotrophic microorganisms which oxidize hydrogen, methane, ammonia, sulfur, iron and other compounds. (3) Search for bacteria which carry out anaerobic photosynthesis. Nephelometry, manometry, and pH determination are discussed as approaches for recording cell division; and extreme conditions which might be found in space are noted. M.W.R.

N67-12732# Stanford Univ., Calif.

EXOBIOLOGY: APPROACHES TO LIFE BEYOND THE EARTH

Joshua Lederberg *In* NAS-NRC Extraterrest. Life 1966 p Reprinted (See N67-12721 03-04)
Available from NAS-NRC, Washington, D. C.: $6.00

Various theories related to the origin of life are discussed, and motivations for exobiological research are treated. In terms of evolving a definition of life, one of the main objectives of exobiological studies is to compare the overall patterns of chemical evolution of the planets. Natural and artificial panspermia and the migration of spores from one planet to another are considered; and planetary targets for research are mentioned. Experimental approaches that are considered feasible are discussed, and the conservation of natural resources beond the earth is treated. M.W.R.

N67-12733# Esso Research and Engineering Co., Linden, N. J.

EVIDENCE IN METEORITES OF FORMER LIFE: THE ORGANIC COMPOUNDS IN CARBONACE EOUS CHONDRITES ARE SIMILAR TO THOSE FOUND IN MARINE SEDIMENTS

Warren G. Meinschein, Bartholomew Nagy, and Douglas J. Hennessy (Fordhan Univ). *In* NAS-NRC EXtraterrest. Life 1966 p (See N67-12721 03-04) Available from NAS-NRC, Washington, D.C.: $6.00

Studies relating to the theory that certain meteorites were once a part of the extraterrestrial biosphere are discussed, particularly in relation to the carbonaceous content of Orgueil and other chondrites. The compositions of benzene extracts of soils and marine sediments from various geographical regions on earth are used as references, and it is postulated that these extracts retain evidence of biological activity. It is assumed that similarities between terrestrial and meteoritiextracts constitute evidence that the meteorites were either contaminated while on earth or are a part of a parent body which once supported life. Aromatic hydrocarbons are common to both terrestrial and meteoritic sediments; and saturated hydrocarbons isolated from the Murray and Orgueil carbonaceous chrondrites have infrared spectra, molecular weight patterns resemblind those of other sedimental saturated hydrocarbons. Except for the relative simplicity of the aromatic fraction from the Orgueil fragment, analyses of both chrondrite extracts fall within the compositional variations observed in terrestrial sediment extracts of plane and animal hydrocarbons. M.W.R.

N67-12734# California Univ., Berkeley.

THE FORMATION OF ORGANIC COMPOUNDS ON THE PRIMITIVE EARTH

Stanley L. Miller *In* NAS-NRC Extraterrest. Life 1966 p 166–181 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Experiments are described that indicate electrical discharges in a mixture of methane, ammonia, hydrogen, and water will produce amino, hydroxyl and aliphatic acids. These same compounds are formed with both spark and silent discharges; when methane, nitrogen, water, and hydrogen are sparked; and when ferrous sulfate is added to the system. Hydrogen cyanide and aldehydes are direct products of the electrical discharge; and these react to produce amino and hydroxylnitriles, which are hydrolyzed to the corresponding acid. It is proposed that the same types of compounds would be synthesized if the earth had a reducing atmosphere, but that there would be no organic compound synthesis if oxidizing conditions were present. Therefore, if it is assumed that amino acids and other organic compounds must be present for life to arise, then the atmosphere of the earth must have been reducing and ammonia must have been present in the oceans for the synthesis of amoni acids. This implies that the partial pressure of hydrogen was at least 10^{-3} atmospheres. M.W.R.

N67-12735# California Univ., Berkeley.

ORGANIC COMPOUND SYNTHESIS OF THE PRIMITIVE EARTH

Stanley L. Miller and Harold C. Urey (Calif. Univ., San Diego) *In* NAS-NRC Extraterrest. Life 1966 p 182–195 Reprinted Sponsored in part by NSF (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Escape of hydrogen and equilibria of carbon and nitrogen compounds are discussed in relation to the synthesis of organic compounds in the primitive atmosphere. It is noted that the hydrogen loss has made for an overall chemical change to an oxidizing atmosphere in place of the original reducing atmosphere. Many complex organic compounds were formed during this change, thereby establishing a favorable environment for the development of life. Electric discharges, ultraviolet light, radioactivity and cosmic rays, thermal energy; and surface reactions, organic phosphates, and porphyrins are discussed. Intermediate stages in chemical evolution are considered in an attempt to understand the origin of life, and speculations are made on the possibility of life on other planets. M.W.R.

N67-12736# Houston Univ., Tex.
SYNTHESIS OF PURINES UNDER POSSIBLE PRIMITIVE EARTH CONDITIONS. I: ADENINE FROM HYDROGEN CYANIDE
John Oro and A. P. Kimball *In* NAS-NRC Extraterrest. Life 1966 p 196–206 refs Reprinted (See N67-12721 03-04) Available from NAS–NRC, Washington, D.C.: $6.00
(Grant NSF G-13117)

Adenine has been synthesized in substantial amounts by heating a solution of hydrogen cyanide (1 to 15 M) in aqueous ammonia for one or several days at moderate temperatures (27° to 100°). The insoluble black polymer of hydrogen cyanide was removed by centrifugation and adenine was isolated from the red-brown supernatant by chromatographic methods. The main ultraviolet absorbing compound of the reaction product was identified as adenine by eight different procedures, including ultraviolet spectrophotometry, and melting point of its picrate. From a 11.1 M hydrogen cyanide reaction mixture, at 70°, a yield of 110 mg. of adenine per liter of original reaction mixture was obtained, which could be increased to 685 mg. by evaporation of the supernatant to dryness on the steam bath and subsequent treatment of the residue with hydrochloric acid. Since adenine is an essential building block of nucleic acids and of the most important coenzymes; and since hydrogen cyanide, ammonia, and water are common natural constituents of the solar system, these experiments are considered of significance in relation to the problem of the origin of life. In particular, the experiments provide the first demonstration of the spontaneous synthesis of adenine from simple compounds of carbon and nitrogen under conditions presumed to have existed on the primitive earth. Author

N67-12737# Houston Univ., Tex.
SYNTHESIS OF PURINES UNDER POSSIBLE PRIMITIVE EARTH CONDITIONS. II: PURINE INTERMEDIATES FROM HYDROGEN CYANIDE
John Oro and A. P. Kimball *In* NAS-NRC Extraterrest. Life 1966 p Reprinted (See N67-12721 03-04) Available from NAS-NRC Washington, D.C.: $6.00
(Grant NSF G-13117)

In addition to adenine, the supernatant solution from the product of the basecatalyzed condensation of hydrogen cyanide in aqueous ammonia contains several purine precursors such as 4-amoniomidazole-5-carboxamide, 4-aminoimidazole-5-carboxamidine, formanide, and formamidine. It also contains glycinamide, glycine, alanine, aspartic acid, and a large number of unidentified ultraviolet-absorbing and fluorescing compounds. The data obtained indicate that the mechanism of adenine synthesis occurs by formation of a hydrogen cyanide trimer, possibly aminomalonodinitrile, which either directly or after transformation to its mono- or diamidine condenses with formamidine to form 4-aminoimidazole-5-carboxamidine. This imidazole derivative condenses in the final step with another molar equivalent of formamidine to form adenine. Less likely alternative mechanisms of adenine synthesis are also described. These results are considered to be of significance in relation to the formation of imidazoles and other heterocyclic compounds on the abiotic earth. The fact that not only adenine, but also amino acids and polypeptides can be synthesized under similar conditions to the ones used in these experiments supports strongly the geochemical models with reducing conditions for the formation of biochemical compounds on the primitive earth. Author

N67-12739# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FORMATION OF ADENINE BY ELECTRON IRRADIATION OF METHANE, AMMONIA, AND WATER
Cyril Ponnamperuma, Richard M. Lemmon, Ruth Mariner, and Melvin Calvin (Calif. Univ., Berkeley) *In* NAS-NRC Extraterrest. Life 1966 244–247 refs Reprinted Sponsored in part by AEC (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Synthesis of heterocyclic bases from mixtures of primitive gases is investigated; and it is established that adenine is a product of the electron irradiation of a mixture containing methane, ammonia, and water. An inverse relationship is shown between the amount of hydrogen gas present and the amount of adenine synthesized; and, of the five nucleic acid bases, adenine is the most readily synthesized under prebiotic conditions. In all four experiments performed, and in all four paper chromatographic solvent systems used, a perfect coincidence was found in both position and shape between the inactive carrier adenine and one of the radioactive product spots. No guanine, cytosine, uracil, or thymine were detected in any of the chromatograms. The apparent preference for adenine synthesis may be related to it multiple roles in biological systems; e.g., not only is at a constituent in DNA and RNA, but is also a constituent of many important cofactors. The fact that molecular orbital calculations indicate that adenine has the greatest resonance energy of all the biological important purines and pyrimidines, makes the adenine synthesis more likely and confers radiation stability on it. M.W.R.

N67-12740# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SYNTHESIS OF DEOXYADENOSINE UNDER SIMULATED PRIMITIVE EARTH CONDITIONS
Cyril Ponnamperuma and Patricia Kirk Available from NAS-NRC, Washington, D. C.: $6.00

An appreciable yield of deoxyadenosine can be synthesized under the conditions which appear likely to have existed on the primitive earth. Hydrogen cyanide provides the dehydration reaction needed to link the purine adenine and the sugar deoxyribose, and ultraviolet light appears to activate the reaction. While the ultraviolet appears to enhance the yield, the deoxyadenosine is formed even in the absence of ultraviolet. There is also evidence that cyanimide of Mg^{++} can replace CN^{-} to produce deoxyadenosine; the action of cyanimide may be analagous to that of dicyclohexylcarbodiimide which has been used in the synthesis of nucleotides, but the chemical role of the magnesium is still obscure. M.W.R.

N67-12741# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ON THE ORIGIN AND PLANETARY DISTRIBUTION OF LIFE
Carl Sagan *In* NAS-NRC Extraterrest. Life 1966 p 253–288 refs Reprinted Presented at the 8th Ann. Meeting of the Radiation Res. Soc., San Francisco, 9–11 May 1960 Sponsored by NAS-NRC (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

The role of radiation in the origin and early development of life on earth is considered in relation to studies on extraterrestrial life. Synthesis of organic molecules on the primitive earth, origin of the first self-replicating system, radiation hazards in primitive times, and antimutagenic adaptations and the origin of the cell are discussed; and speculations are made with regard to life in other part of the solar system. Various observations and experiments indicate that simple organic molecules must be produced in the

atmosphere of the Jovian planets by solar ultraviolet or atmospheric electrical discharges; and from the ultraviolet alone, the production rate of molecules per unit area on Jupiter exceeds the meteoritic deposition rate per unit area on earth. The complex organic matter detected in carbonaceous chondrites and observations on the Martian atmosphere and surface are mentioned as indications of extraterrestrial life. M.R.W.

N67-12742# Harvard Univ., Cambridge, Mass. Museum of Comparative Paleontology.
THE NONPREVALENCE OF HUMANOIDS
George Gaylord Simpson *In* NAS-NRC Extraterrest. Life 1966 p 269–281 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

The origin and evolution of life on earth is discussed, and it is concluded that there are no humanoids existing elsewhere on our solar system. While there is probably no extraterrestrial life anywhere in the solar system, the possibility is not wholly excluded for Mars. Nonetheless, it is felt that there are probably forms of life on other planetary systems, but the chances of people on earth learning about these forms of life are very unlikely. M.W.R.

N67-12743# Rochester Univ., N. Y.
EXTRATERRESTRIAL MICROBIOLOGY
Wolf Vishniac *In* NAS-NRC Extraterrest. Life 1966 p 282–284 Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Studies related to possible life on other planets must be concerned with microorganisms because a planetary ecology can be maintained by microorganisms alone and it is technically easier to study the more simple living forms. A summary of oxidation-reduction reactions which affect the balance of nature is presented, and it is concluded that photosynthesis must be the basic economy of Mars as it is on earth. The exploration of life on Mars may be carried out by a device which in principle is a culture tube with a suitable medium that can be monitored for changes in acidity and turbidity; and a proposed apparatus is illustrated. M.W.R.

N67-12744# Harvard Univ., Cambridge, Mass.
LIFE IN THE SECOND AND THIRD PERIODS; OR, WHY PHOSPHORUS AND SULFUR FOR HIGH-ENERGY BONDS ?
George Wald *In* NAS-NRC Extraterrest. Life 1966 p 285–300 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

The natural biological selection of sulfur and phosphorus in organic group and energy transfer functions is discussed. These elements have more open and, usually, weaker bonds than their second period cogeners, oxygen and nitrogen; yet they retain the property to form multiple bonds, a property that is otherwise characteristic of carbon, nitrogen, and oxygen. The capacity to form these multiple bonds contributes principally to the thermodynamics of energy transfer; and, in the case of P and S, the possibility of forming five or six covalent bonds is presented. A wide range of resonance possibilities is introduced among the precursors and products of energy exchange reactions that greatly increases the variety and extent of the energy changes that can occur. The third orbitals in P and S permit the expansion of their valences beyond four; and the relatively wide spacing and weaknesses of the P and S bonds, together with their tendency to add lone electron pairs in their unoccupied third orbitals, induces intrinsic instability and vulnerability to attack by other molecules that promote exchange reactions. M.W.R.

N67-12746# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
AGE OF CRATERS ON MARS
Edward Anders and James R. Arnold (Calif. Univ., San Diego) *In* NAS-NRC Extraterrest. Life 1966 p Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00
(Grants NsG-366; NsG-321; Contract AT(11-1)-382)

Rate of crater formation on Mars is calculated to be about 25 times higher than that on the moon. The crater density observed by Mariner IV points to an age only one-sixth that of the lunar maria, or 300 to 800 million years. Hence, no conclusions can presently be drawn from these photographs concerning the early Martian environment. Author

N67-12756# National Academy of Sciences–National Research Council, Washington, D. C.
BIBLIOGRAPHY ON EXTRATERRESTRIAL LIFE AND RELATED SUBJECTS
In its Extraterrest. Life 1966 p 383–478 refs (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Almost two thousand references to the world literature on extraterrestrial life, natural sciences, and astronomy are presented. The section on extraterrestrial life covers subjects such as interplanetary and interstellar communication and travel; criteria for, origin, and evolution of life; and adaptation of organism, contamination and panspermia, life detection, and sterilization. Chemical reactions, molecular asymmetry and optical activity, photosynthesis, microbiology, geology, and ecology are covered in the section dealing with natural sciences. Planetary environments, atmospheres, and surfaces; the sun and solar system; and asteroids, meteorites, and comets are included under the astronomy section. M.W.R.

N67-12818*# Melpar, Inc., Falls Church, Va.
STUDY FOR CONTROL OF MICROBIAL GROWTH IN MANNED SPACECRAFT Phase I Report, 30 Oct. 1964–30 Jan. 1965
Charles R. Goucher 30 Jan. 1965 98 p refs
(Contract NAS9-3565)
(NASA-CR-65556) CFSTI: HC $2.00/MF $0.75

Spacecraft environmental control systems were examined to locate potential sources of difficulty where microorganisms might grow, concentrate, and cause operational problems. Evaluation criteria applied to known methods of microbial control dealt with power–weight requirements, outgassing properties, mutagenicity, human toxicity, and water potability. Optimum spacecraft locations were determined for the control devices. It was concluded that filtration methods would be most effective in controlling microbial growth in space suits and spacecraft atmospheres. The use of filters with and without impregnation, in addition to a removable biocide, was judged most appropriate for the control of microbial gorwth in the potable and condensate water systems. Several methods were discussed which are capable of rendering a variety of fabrics biocidal or biostatic. An experimental device was designed which employs a series of resins which release a biocidal material in proportion to microbial contamination, then removes the biocide from waters used for drinking or other spacecraft operations. Author

N67-12830# Association Claude Bernard, Paris (France).
IMMUNOLOGY COMPETENT CELLS [LES CELLULES IMMUNOLOGIQUEMENT COMPETENTES]
Brussels, EURATOM, Aug. 1966 21 p In FRENCH; ENGLISH summary
(Contract EURATOM-032-64-1 BIOF)
(EUR-3060.F) CFSTI: HC $1.00/MF $0.50

The theoretical definition of immunologically competent cells is presented, and their action in allogenic grafts described. In studies of the radiosensitivity of these cells in grafting reactions, it was found that radiosensitivity cannot be acquired by contact with the antigen. The value of antinuclear, antibody research as a test of auto-immune reactivity is indicated from neonatal thymectomy investigations. Hematological studies of white blood cells verified that the number of hyperbasophilic cells appearing the third day is

not noticeably different in the group having received the marked lymphoblastes than in the group having received the marked lymphocytes. Briefly outlined also is the sensitivity to various types of chemotherapy of cells involved in various immunization reactions. Transl. by R.Li.

N67-12844# Indian Inst. of Science, Bangalore. Fermentation Technology Lab.

MICROBIAL DECOMPOSITION OF PECTIC SUBSTANCES. IV: BACTERIA DECOMPOSING PECTIN WITH PARTICULAR REFERENCE TO SOME XANTHOMONAS SP

M. H. Bilimoria *In its* J. of the Indian Inst. of Sci., Vol. 48, No. 2 and 3 Jul. 1966 p 53–64 refs (See N67-12843 03-34) CFSTI: HC $3.00/MF $0.75

Out of the 313 bacterial cultures surveyed for pectinolytic activity 70 were found pectinolytic. The enzymes make-up of these pectinolytic bacteria consisted generally of polygalacturonase, pectin methylestrase and *trans*-eliminase systems. All the bacterial pectinases were found to be adaptive in nature. A hitherto unknown mode of attack on the polygalacturonate by *Xanthomonas* pectinase is suspected in as much as a reducing substance (*s*) other than D-galacturonic acid is formed in this system. Some studies regarding the growth of the *Xanthomonas sp.* and elaboration and inhibition of pectinase produced by it were also carried out. Author

N67-12847# Indian Inst. of Science, Bangalore. Fermentation Technology Lab.

SUITABILITY OF THE HIGH TEMPERATURE PRE-INCUBATION METHOD FOR ISOLATION OF PECTINOLYTIC ACTINOMYCETES

A. D. Agate *In its* J. of the Indian Inst. of Sci., Vol. 48, No. 2 and 3 Jul. 1966 p 98–101 refs (See N67-12843 03-34) CFSTI: HC $3.00/MF $0.75

A comparison of pectinolytic properties of actinomycetes isolated from soils by the use of the high temperature pre-incubation method and the conventiona method has revealed the advantage of using the former method for the isolation of pectinolytic species. This method thus holds promise of its exploitation for the isolation of the pectinolytic actinomycetes from any desired ecosystem. Author

N67-12884# Royal Aircraft Establishment, Farnborough (England).

INVESTIGATIONS ON THE PHYSIOLOGICAL MOVEMENTS OF AMOEBA CHAOS CHAOS L. PART II: THE ACTION OF SALYRGAN, CYSTEIN AND ADENOSINE TRIPHOSPHATE [BEWEGUNGSPHYSIOLOGISCHE UNTERSUCHUNGEN AN DER AMOEBA CHAOS CHAOS L. II: DIE WIRKUNG VON SALYRGAN, CYSTEIN UND A.T.P.]

Werner Kappner May 1966 33 p refs Transl. into ENGLISH from Protoplasma (Vienna), v. 13, no. 4, 1961 p 504–529 (RAE-LIB-TRANS-1164) CFSTI: HC $2.00/MF $0.50

The action of salyrgan, cysteine and adenosine–triphosphate on living multinuclear amoebae (Chaos chaos L) has been investigated. Author

N67-12893# Institut Gustave Roussy, Villejuif (France). Biochemistry and Enzymology Lab.

STUDIES ON DNA REPLICATION IN ANIMAL CELLS Annual Report

C. Paoletti, N. Dutheillet-Lamonthezie, Ph. Jeanteur, and A. Obrenovitch Brussels, EURATOM, Aug. 1966 19 p refs (Contract EURATOM-042-64-10 BIOF) (EUR-2959.E) CFSTI: HC $1.00/MF $0.50

Ehrlich and Krebs ascites cells DNA is pulse labelled by ^{3}H-thymidine is vivo and extracted at various times between 5 minutes and 7 hours after this pulse; radioactive material of the 5 min. DNA displays, when compared to bulk DNA, a higher affinity to MAK columns, a slower sedimentation rate and an increased sensitivity to alkaline denaturation without any change in CsCl and Cs_2SO_4 buoyant density. In DNA extracted longer after this pulse, the part of radioactive material which shows up such characteristics becomes progressively less important and in 2 hours DNA the behavior of labelled material and bulk DNA is nearly identical. The best explanation of these data is the existence of structurally modified DNA, correlated to its replications. Author

N67-12902*# Sandia Corp., Albuquerque, N. Mex.

[SCOPE OF WORK FOR SCIENTIFIC AND TECHNICAL ASSISTANCE FOR THE PLANETARY QUARANTINE MISSION] Second Quarterly Report, Period Ending Sep. 30, 1966

Oct. 1966 14 p (NASA Order R-09-019-040) (NASA-CR-80201) CFSTI: HC $1.00/MF $0.50 CSCL 06M

In an effort to provide parameters associated with initial microbial loading on spacecraft surfaces for the planetary quarantine mathematical model, a study was initiated to determine the model best suited for collection and retention of viable particles that may be present in the atmosphere of a defined environment. A sonic disseminator was developed which is used to load a static clean room atmosphere with stable preditable concentration of dry bacterial spores. A vacuum probe was also developed for retrieving bacteria from surfaces for assay purposes. Studies of viable particle adhesion characteristics and of the physics of viable particle retention on surfaces were initiated. Several microbiological support studies ar being initiated to more exactly define some of the biological models which are being transferred into mathematical models. A model was developed which relates total planetary exploration objectives to spacecraft oriented subobjectives. R.N.A.

N67-12925*# Fels Research Inst., Yellow Springs, Ohio.

POTENTIATION OF INSULIN COMA BY SACCHARIN

Elliot S. Valenstein and Margaret L. Weber (Antioch Coll.) Repr. from J. of Comp. and Physiol. Psychol., v. 60, no. 3, 1965 p 443–446 (Grants NsG-437; NIH MH-4529; NIH MH-K6-4947) (NASA-CR-80197) CFSTI: HC $1.00/MF $0.50 CSCL 06P

Rats receiving an injection of insulin which was lethal to approximately 50% of untreated animals were permitted to drink either a saccharin, water, or glucose solution. Saccharin potentiated the effect of insulin, as significantly more Ss of this group succumbed than did those in the water group; Ss that had glucose were protected. It may be an error to assume that saccharin is physiologically inert. Speculation concerning the question of why a non-/nutritive substance such as saccharin may serve as an effective reward for animals is also presented. Author

N67-12930*# IIT Research Inst., Chicago, Ill.

LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Quarterly Status Report, Aug. 15–Nov. 15, 1966

Charles A. Hagen 15 Nov. 1966 18 p (Contract NASr-22) (NASA-CR-80187; IITRI-L6023-7) CFSTI: HC $1.00/MF $0.50 CSCL 06F

Simulated Martian environment experiments were conducted with *Staphylococcus aureus* and the effects of barometric pressures and carbon dioxide concentrations were studied. *S. aureus* grew rapidly in Earth atmospheres at all barometric pressures and concentrations of carbon dioxide. Maximum populations were reached as early as 3 days with an 8-hr daily freeze and 7 days with a 20-hr daily freeze. Maximum populations of *S. aureus* were 100- to 1000-fold higher than initial populations. Brunizemic and podzolic soils tested were adequate to support the growth of *B. cereus, L. plantarum, P. aeruginosa,* Pa 3679, *S. aureus,* and *S. albus.* An 8-hr daily freeze did not affect the growth of these organisms in brunizemic soil, but did decrease or inhibit growth in the podzolic soil. S.P.

N67-12940*# California Univ., Los Angeles.
ALTERED PULMONARY HEMODYNAMICS FOLLOWING EXPERIMENTAL DECOMPRESSION SICKNESS
A. T. K. Cockett and Ray T. Kado [1965] 9 p refs
(Contract NAS2-2151; Grant NsG-237-62)
(NASA-CR-79728) CFSTI: HC $1.00/MF $0.50 CSCL 06E

A new pulmonary isotopic scanning technique prompted development of a method to assess the extent of pulmonary embolism by scanning the pulmonary arteriolar tree prior to and immediately following decompression. Hemodynamic and pathophysiological findinds that occur following lethal decompression from depths in the 165–175 foot range are reported. An abrupt rise in pulmonary arterial pressure following significant decompresion is attributed to the development of a moderate pulmonary arteriolar-capillary blockade. The pulmonary emboli apparently disappear in dextran treated animals within 48 hours. Maintenance of effective pulmonary arterial circulation is apparently due to the mechanisms of dextran replacement and development of collateral circulation in the involved areas. S.P.

N67-12957# Library of Congress, Washington, D. C. Aerospace Technology Div.
BIOLOGICAL EFFECTS OF HIGH-FREQUENCY ELECTROMAGNETIC WAVES Translations of Foreign Scientific and Technical Literature
Vladimir E. Mutschall 13 Jul. 1966 18 p refs
(ATD-66-92)

Physicists, chemists, biologists, and doctors are all interested in finding out whether electromagnetic waves cause chemical and biological changes similar to those brought about by ionic radiation. Previous experimental work on the influence of high-frequency electromagnetic waves on organic and inorganic matter is briefly covered. The influence of high-frequency electromagnetic waves on living matter, especially in the field of microwaves is discussed. Penetration of high-frequency energy into the organism, electromagnetic induction of the body, and the existence of the non-thermal effect of electromagnetic waves are considered. Symptoms of damage are listed and methods of protection discussed. Author

N67-12971*# Exotech, Inc., Washington, D. C.
ANALYTICAL TECHNIQUES IN PLANETARY QUARANTINE AND SPACECRAFT STERILIZATION Final Report
Samuel Schalkonsky Nov. 1966 48 p refs
(Contract NASw-1340)
(NASA-CR-80337) CFSTI: HC $2.00/MF $0.50 CSCL 06M

Analytical methods and calculations are reported which relate (1) the prediction of the hazard of biological contamination of other planets; (2) the specification of planetary quarantine requirements; (3) the functional correlation of experimental data on microbial lethality during heat sterilization; and (4) the proper allowance for integrated lethality during transient heat-up and cool-down of a space capsule. Existing analytical techniques in the field of sterilization are found to be inadequate for the planetary quarantine program and improved methods have therefore been developed in all of the areas considered. These are summarized in the report and related documentation. Author

N67-12979*# Colorado State Univ., Fort Collins. Dept. of Physiology.
STUDIES ON THE INCORPORATION OF ISOTOPICALLY LABELED NUCLEOTIDES AND AMINO ACIDS IN PLANARIA
Jay Boyd Best, Robert Rosenwold, Jacqueline Souders, and Carlton Wade Repr. from J. Exptl. Zoology, v. 159, no. 3, Aug. 1965 p 397–403 refs
(Grants NsO-625; NIH-MH-07603-02-EP-RO1)
(NASA-CR-80367) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Neither intact nor regenerating planaria incorporated any significant amount of tritiated thymidine, tritiated L-leucine, or C^{14}L-leucine from free solution even over long periods of exposure. Tritiated thymidine was incorporated into regenerating rat liver and fed to planaria, but tritium hydrogen exchange rendered this method useless. A large incorporation of C^{14}-uracil and C^{14}L-leucine into planaria was obtained by growing baker's yeast in a defined medium containing the labeled compound and then feeding the acetone dried yeast to the planaria. C^{14} assay of the amino acid components of planaria fed on C^{14}-L-leucine labeled yeast showed C^{14} in only the L-leucine component and yielded a minimum estimate for protein turnover of 46% in seven weeks. Radioautographs of planaria fed on C^{14}-uracil labeled yeast exhibited specific incorporation into ribonucleic acid. Previous radioisotopic studies on planaria are evaluated. Author

N67-12980*# Ohio State Univ. Research Foundation, Columbus. Environmental Medicine Lab.
CARDIOVASCULAR EFFECTS OF VIBRATION Semiannual Report, 1 Feb.–3 Jul. 1966
Lester B. Roberts and John H. Dines Oct. 1966 22 p
(Grant NGR-36-008-041; RF Proj. 2045)
(NASA-CR-80356, Rept.-2) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Presented are descriptions and results of two studies. In the first study, cardiovascular changes during vibration were observed in a dog after administration of propranolol. Apart from a slower initial heart rate, the results were similar to those obtained under control conditions before propranolol was given. Cardiac output, $(dp/dt)_{max}$ of LVP, and fluctuations in blood pressure were observed. No changes in left ventricular end-diastolic pressure were noted. In the second study, the effects of electrode design, skin preparation, and electrode placement in reducing electrical noise in electrocardiograph signals obtained from human subjects during vibration were observed. Experimental procedures are described in detail. It is concluded that if procedures are followed as outlined, a minimum of electrical noise usually associated with ECGs can be expected during recordings from human subjects being vibrated. K.W.

N67-12997*# Exotech, Inc., Alexandria, Va.
LOG-NORMAL MODEL FOR MICROBIAL SURVIVAL IN HEAT STERILIZATION
Samuel Schalkowsky and Robert Wiederkehr Oct. 1966 40 p refs
(Contract NASw-1340)
(NASA-CR-80373; TR-015) CFSTI: HC $2.00/MF $0.50 CSCL 06M

An analytical model is developed for the survival times of organisms in heat sterilization in which the probability of inactivation as a function of exposure time is log-normally distributed. Experimental data is examined relative to this model and it is concluded that the model is valid except during the initial period of heating when an additional interaction between the organisms and their surrounding medium appears to be present. At long heating times, the log-normal model appears more accurate for extrapolating to low survival probabilities than the usual logarithmic survivor curves and it generally more conservative. Author

N67-13002*# California Univ., La Jolla. Dept. of Chemistry.
HYDROCARBONS IN THE BANANA LEAF, MUSA SAPIENTUM
Bartholomew Nagy, Vincent Modzeleski, and Marty T. J. Murphy Repr. from Phytochemistry, v. 4, 1965 p 945–950 refs
(Grant NsG2541)
(NASA-CR-80360) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Several long-chain n-alkane compounds have been identified by the vapor phase chromatography of urea adducted samples which were prepared from the n-hexane eluate fractions of the chloroform–methanol extracts of homogenized leaves. In addition, certain types of alkyl-substituted, fused polycyclic aromatic hydrocarbons have been determined by mass spectrometry, fluorometric, u.v., and i.r. spectroscopy in fractions isolated by preparative thin-layer chromatography from saponified banana leaf

extracts. The hydrocarbon composition of most banana leaf extracts differed in part from the hydrocarbon compositions of other plants, namely two xerophytic angiosperms, a moss, a marine alga, a mushroom and two dissimilar red bacteria. Author

N67-13007*# Colorado State Univ., Fort Collins.
BEHAVIOUR OF PLANARIA IN INSTRUMENTAL LEARNING PARADIGMS
Jay Boyd Best Repr. from Animal Behaviour Suppl. I. [1963] p 69–75 refs
(Grants NsG-625; NIH G-MH-076203-02)
(NASA-CR-80380) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Several experiments conducted to study the behavior of worms are discussed, and their reactions to an imprisoning environment are analyzed. Various response patterns are compared with those observed in high vertebrates, and several similarities are noted. Conflict behavior was noted around the end of the first training session; it is pointed out that this is about the point where it would appropriately be manifested in a higher animal such as a rat. In other tests, an improved learning performance was observed at the beginning of the second session. This phenomenon, in which learning occurred during a period of no overt practice, is considered to be similar to the reminiscence effect formed previously in mammals. The effect of the lunar cycle on performance is also assessed. M.G.J.

N67-13010*# Cincinnati Univ., Ohio. Coll. of Medicine.
THE EFFECT OF NEUTRAL AND ACIDIC POLYSACCHARIDES ON NATURAL RESISTANCE OF MICE TO BACTERIAL CHALLENGE
Peter F. Bonventre and Bernard Black-Schaffer Repr. from J. of Infectious Diseases, v. 115, Oct. 1965 p 413–420 refs
(Grants NsG-75; PHS-AI-04315)
(NASA-CR-80377) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Experiments were conducted to determine the effect of several dextrans and dextran sulfates on the resistance of mice to either staphylococcal or shigella infection. The data show that nonionic dextrans have no effect on resistance; acidic dextran sulfates, however, demonstrated a significant resistance-lowering capacity. The results also suggest that both the size and net charge on the polysaccharide molecule contribute to its ability to alter host resistance. The high molecular weight dextran sulfate was found capable of either decreasing or increasing resistance to bacterial challenge. This dual effect was correlated with reticuloendothelial blockade and reticuloendothelial stimulation, respectively. M.G.J.

N67-13015*# California Univ., Los Angeles.
RENAL LYMPH OXYGEN TENSION DURING GRADED RENAL ISCHEMIA
A. T. K. Cockett, M. Kazmin, R. S. Moore, R. T. Kado, and R. P. Roberts [1963] 2 p ref
(Grants NsG-237-62; PHS-G-HE-09834-02)
(NASA-CR-79736) CFSTI: HC $1.00/MF $0.50 CSCL 06P

Summary data are presented on experiments in which the renal lymph fluid of dogs was collected as a means of assessing tissue oxidation. Normal renal lymph oxygen tension is listed. The results suggest that oxidative metabolic processes are extremely active within the kidney; renal lymph oxygen tension levels significantly exceeded the arterial levels. M.G.J.

N67-13068# Library of Congress, Washington, D. C. Aerospace Technology Div.
PROBLEMS OF SPACE MEDICINE Surveys of Foreign Scientific and Technical Literature
B. Mandrovsky, C. Dodge, D. Pyle, and J. Smith 13 Sep. 1966 272 p refs Compilation of Abstracts
(ATD-66-116)

This compilation is based on papers presented at the conference sponsored by the Moscow Physiological Society and the Institute of Biomedical Problems of the USSR Ministry of Health. There are eleven parts in this report: general and methodology; experiments in space; effects of combined factors; dynamic factors; radiobiology; gas environment and respiratory problems; isolation, hypokinesia, and orthostatic problems; miscellaneous problems; selection and training; life support systems; and biotelemetry and human engineering. Author

N67-13100*# Naval School of Aviation Medicine, Pensacola, Fla.
ACUTE ALCOHOL ATAXIA IN RELATION TO VESTIBULAR FUNCTION
Alfred R. Fregly and Ashton Graybiel 22 Jun. 1966 16 p refs
(NASA Order R-93)
(NASA-CR-80433; NAMI-973) CFSTI: HC $1.00/MF $0.50 CSCL 06P

Determination of alcohol effects on postural equilibrium of bilateral labyrinthine defective individuals was made to aid in the elucidation of the functional role of the vestibular organ in man. Generally, severity and duration of the intoxicating effects were found to be less than those observed in a previous study on vestibular-intact individuals. The superimposition of an "acute alcohol ataxia" on vestibular-impaired individuals appears to depend upon the degree to which nonvestibular functions can be made to compensate for the initial characteristic vestibular ataxia. Author

N67-13113*# Catholic Univ. of America, Washington, D. C. Dept. of Biology.
GENETIC STUDIES OF HYDROGEN BACTERIA AND THEIR APPLICATIONS TO BIOLOGICAL LIFE SUPPORT SYSTEMS Status Report No. 3, May 1–Oct. 31, 1966
B. T. De Cicco 31 Oct. 1966 15 p ref
(Grant NGR-09-005-022)
(NASA-CR-80432) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Mutant *Hydrogenomonas eutropha* cultures resistant to each of four bacteriophage types were obtained by exposing a large bacterial population to a large number of phages on heterotrophic agar. Phage resistant clones were then isolated and tested for their sensitivity to the other three phage types. The results are tabulated, and the data are discussed. The growth of *H. eutropha* under simultaneous autotrophic and heterotrophic conditions; and work efforts concerning the determination of nutritional requirements of *H. eutropha* auxotrophs are also discussed. A closed environment chemostat for cultivation of hydrogen bacteria for cultural stability studies is described and a diagram of the chemostat is depicted. L.S.

N67-13128*# California Univ., Berkeley. Space Sciences Lab.
STUDY OF GROWTH IN RECENT AND FOSSIL INVERTEBRATE EXOSKELETONS AND ITS RELATIONSHIP TO TIDAL CYCLES IN THE EARTH–MOON SYSTEM Semiannual Report, May 1–31, 1966
W. B. N. Berry 30 Sep. 1966 7 p *Its* Space Sci. Lab. Ser. No. 7, Issue No. 45
(Grant NGR-05-003-067)
(NASA-CR-80485) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Techniques for discerning growth cycles in fossil pelecypod shells and a tentative morphogenetic classification of those cycles are presented. Estimations of the length of the months and years in the prehistoric past are made based on the relationship between environmental rhythms and the growth cycles. The growth layers observed in the shells of both fossil and modern pelecypods are tentatively classified in six types. Investigations indicate a slow and continual decrease in number of months per year, from 13 in the Carboniferous period to 12.5 in the Cretaceous, to 12 at the present time. Somewhat more synodic days per month appeared in the Cretaceous than at present. It is suggested that changes in distribution of angular momentum have taken place within the earth-moon system. S.P.

N67-13129*# Public Health Service, Cincinnati, Ohio. Div. of Environmental Engineering and Food Protection.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Sixth Quarterly Report, Jul. 1–Sep. 30, 1966
Robert Angelotti Oct. 1966 19 p ref
(NASA Order R-36-015-001)
(NASA-CR-80484) CFSTI: HC $1.00/MF $0.50 CSCL 06M

The dry heat resistance of *Bacillus subtilis* var. *niger* spores encapsulated in Lucite rods at an inoculum of approximately 1×10^9 spores per gram and exposed to temperatures of 105, 120, and 160°C was determined. The D values and their corresponding 95% confidence intervals were found to range respectively: $D_{105} = 1.2$ to 1.3 days, 95% C.I. of 1.1 to 1.5 days; $D_{120} = 5.9$ to 6.2 hours, 95% C.I. of 5.0 to 6.8 hours; $D_{160} = 4.6$ to 4.8 minutes, 95% C.I. of 3.8 to 4.9 minutes. A decimal reduction time curve was constructed employing the D values from all temperatures studied to date. The slope of this curve over the temperature range of 105°C to 160°C yielded a value of $z_D = 20.8$ Centigrade degrees. Author

N67-13144# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Institut fuer Flugmedizin.
GASCHROMATIC COLUMN CIRCUIT FOR ANALYSIS OF GASES IN CLOSED SYSTEMS FOR BIOLOGICAL AND BIOMEDICAL INVESTIGATIONS [GASCHROMATOGRAPHISCHE KOLONNENSCHALTUNG FUER DIE ANALYSE DER GASE IN GESCHLOSSENEN SYSTEMEN FUER BIOLOGISCHE UND BIOMEDIZINISCHE UNTERSUCHUNGEN]
Wolfgang Brieglab Sep. 1966 11 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-60; DVL-566) CFSTI: HC $1.00/MF $0.50

Description of a variable gaschromatic column circuit for measuring O_2, N_2, CO_2, CO, HE, Ar and also the lower hydrocarbons in a single run. Author

N67-13153# Institut Gustave Roussy, Villejuif (France).
RECOVERY EFFECT OF NUCLEIC ACIDS AFTER IRRADIATION [EFFET RESTAURATEUR DES ACIDES NUCLEIQUES APRES IRRADIATION] Annual Report
Brussels, EURATOM, Aug. 1966 18 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-055-64-10 BIOF)
(EUR-2765.F) CFSTI: HC $1.00/MF $0.50

In an attempt to study the radiorecovery effect of desoxyribonucleic acid (DNA) on cultured mammal cells, tests were performed to determine whether the acid penetrates the cells under experimental conditions. The cell used was obtained from a cell of male mouse fibroblasts and was selected for its characters stability and because radiobiological studies could be carried out with it (in particular, survival curves). After two hours contact with the radioactive DNA, the cells are lysed and the cellular and exogenous DNA separated by density gradient in caesium chloride. Measurement of the radioactivity and DNA content of each fraction of the gradient shows that: the exogenous DNA penetrates the cells; this penetration is proportional to the quantity of DNA in contact with the cells; and the hypothesis to the effect that the tracer is re-used by the cells can be discounted, since the radioactivity is localized in the gradients in a very narrow strip of the DNA peak. Author

N67-13182*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY-A CONTINUING BIBLIOGRAPHY WITH INDEXES, OCTOBER, 1966
Nov. 1966 180 p refs
(NASA-SP-7011(30)) CFSTI: HC $1.00/MF $1.00 CSCL 06S

A selection of annotated references to unclassified reports and journal articles in aerospace medicine and biology is presented that were introduced into the NASA information system during October, 1966. Emphasis is placed on biological, physiological, psychological, and environmental effects to which man is subjected during the following simulated or actual flight in the earth's atmosphere or in interplanetary space. G.G.

N67-13197*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL COMPUTER PROCESSING OF X-RAY PHOTOGRAPHS
R. H. Selzer 15 Nov. 1966 23 p refs
(Contract NAS7-100)
(NASA-CR-80521; JPL-TR-32-1028) CFSTI: HC $1.00/MF $0.50 CSCL 06B

The interpretation of medical and biological pictures, such as X-ray photographs, can frequently be made easier if selected portions of the image are first enhanced by means of a digital computer. Two particular enhancement methods are described in this report. The first method uses image subtraction to achieve enhancement by removing unimportant information from the picture. The second method uses two-dimensional filtering to achieve enhancement by emphasizing selected portions of the picture frequency spectrum. This filtering method is particularly useful for bringing out fine detail that is totally invisible on the unprocessed picture. Examples of enhanced medical X-rays, photomicrographs, and infrared photographs are shown. Author

N67-13251# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
A FORTRAN IV PROGRAM FOR EVALUATION OF THYROIDAL ASSIMILATION OF RADIOIODINE
Norman R. French Jun. 1966 13 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-592) CFSTI: HC $1.00/MF $0.50

A fortran IV program was developed for the computer reduction of data on the thyroid uptake and effective half-life of ingested 131I in different mammalian species and of members of the same species on different diets. Experimental animals were given a measured quantity of 131I solution orally and the radioactivity from the thryoid was counted by means of a scintillation counter twice in the first 24 hr and daily thereafter for 14 days. The animals were sacrificed and the thyroid was counted in a well-typed scintillation detector. The counting data were used to calculate the effective half-life of 131I in the thyroid of each animal and the mean, standard deviation, the sum of deviations squared for each group of animals, and the effects of diet on ^{131}I uptake by the thyroid gland. NSA

N67-13253# Oak Ridge National Lab., Tenn. Health Physics Div.
SAFETY ANALYSIS OF RADIONUCLIDE RELEASE TO THE CLINCH RIVER Progress Report No. 3
K. E. Cowser and W. S. Snyder May 1966 152 p refs Presented at the Clinch River Study Steering Comm. Meeting, 15–16
(Contract W-7405-ENG-26)
(ORNL-3721, Suppl. 3) CFSTI: HC $4.00/MF $0.75

One of the principal objectives of the Clinch River Study has been the evaluation of radiation dose equivalent to populations downstream from operations at the Oak Ridge National Laboratory. Evaluation was based on long-term monitoring data (1944 to 1963) and the identification of critical exposure pathways and population groups. Knowledge of water utilization downstream indicates that the important avenues of exposure from discharge of low-level contaminated waste water to the Clinch River include consumption of contaminated water and fish, consumption of agricultural produce that may be irrigated with river water, exposure to contaminated water and bottom sediments during recreational and industrial use of the water, and exposure to buildup of sludge

and deposits in water systems utilizing river water. The major sources of exposure are currently the ingestion of contaminated water and fish. Mathematical models were developed for internal dose calculations and include the differences in intake and in size of the critical organ as a function of the individual's age. It was found that the skeleton of man received the largest exposure and ^{90}Sr was responsible for more than 99% of the dose equivalent. Based upon realistic but conservative assumptions, the estimated total doses from internal and external sources (20 year period) received by the skeleton of critical population groups, the 18-year-old individuals (in 1944) utilizing the Clinch River and the 14-year-old individuals (in 1944) utilizing the Tennessee River were 3.2 Rem and 0.45 Rem, respectively. These values are about a factor of 10 less than permissible limits established by ICRP and FRC. Methods of calculation are presented, and examples are given for the transfer of ^{90}Sr and ^{137}Cs to man by irrigation water. If irrigation is practiced on the Clinch River in the future, it may become the dominant exposure pathway. It is noteworthy that in 1962 and 1963 fallout from nuclear tests contributed the same quantity of the critical radionuclide, ^{90}Sr, to the Clinch River as did purposeful releases from the laboratory. Author (NSA)

N67-13259*# Fairchild Engine and Airplane Corp., Farmingdale, N. Y.

EFFECT OF DIET AND ATMOSPHERE ON INTESTINAL AND SKIN FLORA. VOLUME II: LITERATURE SURVEY

Phyllis E. Risly and Lorraine S. Gall Washington, NASA, Dec. 1966 137 p refs

(Contract NAS9-4172)

(NASA-CR-662) CFSTI: HC $3.00/MF $1.00 CSCL 06M

A review and evaluation of the literature concerning the microflora of the integument, i.e. microorganisms which exist in or on the skin, is presented. Considered are the following general and specialized skin areas: anal fold; axilla; external ear; eye; fingernails; scalp; toenails; and umbilicus. Both aerobic and anaerobic bacteria as well as yeasts, molds, fungi, actinomyces, and viruses are included. In addition, pertinent observations made during two studies of men subjected to certain simulated space flight conditions are reported. The first study included a comprehensive microbiological survey of the skin flora from four groups of four men who were confined for 33 days and who were sampled in several skin areas 13 times during that period. In the second study, six of the men were confined together under the test atmosphere, while two men, who served as control, were confined at ambient atmospheres. K.W.

N67-13272# California Univ., Los Angeles. Dept. of Anatomy.

IRRADIATION EFFECTS ON BRAIN WAVE CORRELATES OF CONDITIONED BEHAVIOR Final Report, 1960–1965

W. R. Adey and R. L. Schoenbrun [1966] 72 p

(Contract AT(11-1)-34)

(UCLA-34P60-1) CFSTI: HC $3.00/MF $0.75

The effects of low doses of x irradiation on brain wave activity recorded from temporal lobe structures during conditioned behavior in the cat were studied. A major effort was directed to evaluation of several behavioral training techniques with concurrent EEG recording. Initial studies utilized 250 kv X rays in doses ranging from 100 to 1,500 R delivered to the whole head. Later studies involved a technique of focal brain irradiation with 910 Mev γ particles that permitted selective irradiation of discrete regions. A novel stereotaxic alignment frame was designed for precision placement in focal irradiations. Data are presented on electrophysiological behavioral and morphological changes induced by whole head or focal exposure. NSA

N67-13325# Michigan State Univ., East Lansing. Dept of Botany and Plant Pathology.

FACTORS RESPONSIBLE FOR CHANGES IN RADIOSENSITIVITY OF EMBRYONIC TISSUES Technical Progress Report, 1965–1966

L. W. Mericle and R. P. Mericle 31 May 1966 20 p refs

(Contract AT(11-1)-1400)

(COO-1400-10) CFSTI: HC $1.00/MF $0.50

Factors responsible for changes in radiosensitivity of embryonic tissues were studied in barley and Tradescantia. Results are summarized from studies of the normal pattern of floral bud development in hybrid Tradescantia plants; the occurrence of spontaneous color mutants in Tradescantia; the influence of environmental factors and influorescence age on the radiosensitivity of Tradescantia bud clusters exposed to 60 R X radiation; the genetic effects of uv, visible light, chronic, low-level 60Co γ irradiation, and diurnal temperture variations in Tradescantia; the effects of a single acute exposure to 450 R X radiation on barley embyro material, and the biological effects of ^{60}Co γ radiation in the first 3 to 5 mm of tissue depth in barley heads containing embryos and in Tradescantia. NSA

N67-13339# Worcester Foundation for Experimental Biology, Shrewsbury, Mass.

[STEROID SYNTHESIS, ANALYSIS, AND METABOLISM] Progress Report, 1 May 1965–30 Apr. 1966

Gregory Pincus 13 Jun. 1966 25 p refs

(Contract AT(30-1)-918)

(NYO-918-15) CFSTI: HC $1.00/MF $0.50

Developments are reported for studies on: synthesis of steroid labeled radioisotopes; application of methods for automation of steroid analysis; steroid biogenesis and metabolism; and effects of radiation on steroid metabolism. NSA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N67-12341# Joint Publications Research Service, Washington, D. C.

REPORTS ON SOVIET RESEARCH IN THE FIELD OF BIONICS

A. I. Prokhorov, ed. 21 Nov. 1966 145 p refs Transl. into ENGLISH of the Publ. XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio. Doklady Sektsii Bioniki (Moscow), 1966 p 1–135

(JPRS-38716; TT-66-35140) CFSTI: $4.00

The conference proceedings which are presented cover various aspects of man–machine systems, model construction of human systems, simulation studies, computer processing techniques, and bioelectrical effects. M.G. J.

N67-12342# Joint Publications Research Service, Washington, D. C.

SOME PROBLEMS IN MONITORING, PROGNOSIS AND CONTROL OF THE STATE OF THE MAN–MACHINE SYSTEM

A. I. Prokhorov *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 1–4 (See N67-12341 03-05) CFSTI: $4.00

The difficulty, efficiency, and reliability of various methods of monitoring, predicting, and controlling the state of the human operator in man–machine systems are discussed. The dependence of the capacity to work on the physiological and psychological states is considered. Parameters describing the state are divided into two classes for discussion: dynamic (e.g., attention, perception, ready-access memory) and static (e.g., typological and age characteristics, habits, behavior modes). Also discussed is the possibility of an automatic control system with feedback, which by evaluating the general emotional tension of the operator in accord with evaluating and directing his attention, controls the state of the human operator. L.E.W.

N67-12343# Joint Publications Research Service, Washington, D. C.

UNIVERSAL ANALYZER OF A MULTICHANNEL DIAGNOSTIC SYSTEM MADE OF STANDARD ELEMENTS

R. S. Dadashev *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 5–9 (See N67-12341 03-05) CFSTI: $4.00

The construction of multichannel diagnostic systems for analyzing physiological states is discussed, considering various procedures and devices for analyzing physiological parameters. Each physiological parameter characterizes a set of signs expressed in various indices of the electrical signal. The development of a circuit of a universal integrator with a linear scale of measurement within the range of 0 to 100 V is discussed. The integrator is equipped with additional matching elements permitting averaging both of the pulse information (ECG, respiration) and signals of the potential type (O_2 in the blood) or given in the form of functions (EEG, EMG). Complex oscillations of the biopotentials are analyzed with the help of a set of filters each of which passes a narrow band of frequencies. As a result of synthesis of all the circuits of the analyzer, it was concluded that the parameters of the various signals may be measured with a set containing a rectifier, threshold element, flip-flop, kipp relay, filter, and operation amplifier in various switching modes. L.E.W.

N67-12347# Joint Publications Research Service, Washington, D. C.

CUTANO–GALVANIC STIMULATION AS A MEANS OF SUPPLYING INFORMATION TO THE OPERATOR

O. B. Aksenov *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 28–31a refs (See N67-12341 03-05) CFSTI: $4.00

Experiments conducted to examine the possibilities of the tactile channel for supplying information to the human operator are described. The first experiments were concerned with the feelings arising during cutano–galvanic stimulation. It was concluded that electrical stimulation of the skin may provide a sensation of touch at a frequency of 8 cycles for about 1 sec; during stimulation with low frequency (up to 1 cycle) the sense of touch rises with a significant increase in amplitude; at high frequencies the dynamic range of possible stimuli is relatively small; and an important parameter in measuring tactile sensitivity is pulse length. Further experiments, investigating variations in thresholds with time, indicated that repeated cutano–galvanic stimulation with a 10-min interval for 30 min and more leads to stabilization of the tactile threshold of feeling. Tests were also conducted with respect to indication of location of the stimulus; after adjustment of the intensity of the stimulation and 30 min of training the examinee exactly indicated the location of the stimulation in 37% of the cases. L.E.W.

N67-12348# Joint Publications Research Service, Washington, D. C.

AN APPROACH TO THE STUDY OF THE PROCESSES OF FORMATION OF VISUAL IMAGES

I. V. Bushara, O. Ya. Kobrinskaya, and I. B. Muchnik *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 32–37 refs (See N67-12341 03-05) CFSTI: $4.00

Experiments in the simulation of the processes of visual perception, and especially in the formation of visual shapes, are discussed. The hypothesis of compactness is considered, which begins with the assumption that any set of images must have some universal property so that a man with appropriate training can assign the elements of this set to an image. Problems in the hypothesis are also pointed out. A set of experiments to test the hypothesis is proposed and other experiments, already carried out in the field, are summarized. L.E.W.

N67-12349# Joint Publications Research Service, Washington, D. C.

EXPERIMENTS IN DISCRIMINATION BETWEEN COMPACT SETS OF IMAGES

I. V. Bushara, O. Ya. Kobrinskaya, and I. B. Muchnik *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 38–41 (See N67-12341 03-05) CFSTI: $4.00

Experiments conducted with 12 children (aged 4 to 6) to study the possibility of formation of a generalized representation of a compact set of images are described in detail. The classes of patterns belonged to two different compact sets, and the children were told to separate them into two groups. Fifteen to twenty experiments were conducted with all the examinees; nine learned to separate the pictures without errors, but three did not. It was felt that the results did not determine the role of the property of compactness in the formation of visual patterns; nevertheless, it can be assumed that compactness permits man to form a generalized representation of a practically infinite class of images new to him. L.E.W.

N67-12350# Joint Publications Research Service, Washington, D. C.

ANALYSIS OF THE RESULTS OF EXPERIMENTS IN THE DEVELOPMENT OF DISCRIMINATION OF COMPACT SETS OF IMAGES

I. V. Bushara, O. Ya. Kobrinskaya, and I. B. Muchnik *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 42–47 (See N67-12341 03-05) CFSTI: $4.00

The influence of age characteristics on the development of visual discrimination of compact sets of images was investigated, and a comparative analysis of the results is presented. It was concluded that the decisive factor was not age but rather the degree of development in the examinee of the processes of analysis. It was noted that the examinees poorly trained in mathematics but well trained in foreign languages and the humanities had high indices. All the examinees (117) after some period of training started to correctly distinguish the images. It was felt that the results proved that the compactness of images plays an important role in the processes of formulation of visual discrimination. L.E.W.

N67-12351# Joint Publications Research Service, Washington, D. C.

THE RELATIONSHIP OF THE METRICS OF VISUAL AND AURAL SPACES FOR A PROCEDURE TO CONVERT AN IMAGE INTO A SOUND

V. G. Grishin *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 48–53 refs (See N67-12341 03-05) CFSTI: $4.00

An algorithm for converting images into sound was investigated from the viewpoint of general criteria of the pattern recognition theory, which is not directly related to the psychophysiology of the operator. These criteria are defined as the distance between the classes of patterns and the metric parameters of the classes in an N-dimensional space of signs in which any possible realization of any class is represented by a point. Brightness of the individual points was selected as the signs of initial visual patterns, so that each image corresponds to a point (vector) in the N-dimensional space where N is determined by the difference in detail of the pattern required by the resolution capacity. Equations are formulated, and simplifications of the formula are considered. L.E.W.

N67-12352# Joint Publications Research Service, Washington, D. C.

EVALUATION OF A PROCEDURE FOR CONVERSION OF AN IMAGE INTO SOUND

V. G. Grishin *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 54–59 refs (See N67-12341 03-05) CFSTI: $4.00

The conversion of an image into sound is discussed in relation to expanding the possibilities of the human operator in monitoring control systems and especially in reducing the demands on his vision. A conversion procedure was evaluated, and several conclusions were reached. The analyzing system must have a number of filters corresponding to the number of lines of quantification of the initial image where the characteristic frequencies of the circuits must compare with the carrier frequencies of the transformation. The restrictions of the audible range of frequencies, the restrictiveness of the time of reading the pattern, and the necessity of distinguishing the carrier frequencies lead to the restriction of the allowable number of rows of expansion of the initial image. L.E.W.

N67-12353# Joint Publications Research Service, Washington, D. C.

PROBLEMS IN SIMULATING HUMAN HEARING

Yu. P. Shabanov-Kushnarenko, and G. F. Dyubko *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 60–63 refs (See N67-12341 03-05) CFSTI: $4.00

The mathematical simulation of the functions of human hearing is considered, and the method of the cybernetic black box to simulate hearing on the basis of a study of the psychophysical reactions of the organ of hearing is discussed. It is stated that the input signal E(t) of the hearing organ is the sound oscillogram; the input signal may be an aural sensation considered as a set of sounds H of different pitch or as a subjective sound spectrum varying in time H(t). The problem of finding the algorithm for converting all possible input signals E(t) into output signals H(t) is then considered. An analogy with a vibrating string is used for constructing the model, and the processes that occur in the model are described mathematically. L.E.W.

N67-12354# Joint Publications Research Service, Washington, D. C.

EXPERIMENTS IN CHECKING A MODEL OF VISION IRRADIATION

Yu. P. Shabanov-Kushnarenko *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 64–69 refs (See N67-12341 03-05) CFSTI: $4.00

Analytical relations were obtained for describing the laws of threshold visibility of objects having small angular dimensions. Experiments are described which confirm these relations under the condition that the brightness of the object differs from the brightness of the background by a small magnitude (up to 10 threshold values). The first experiment described consisted of determining the conditions of threshold visibility of a narrow ray band on a white background. The second experiment included the determination of the conditions of comparison of the series made up of 12 grey concentric bands. The third experiment retained the constant width of the period, but varied the width of the grey band. Good correspondence was obtained with the theoretically derived model reactions, and it was concluded that the experiments supported the validity of the mathematical model of vision radiation. L.E.W.

N67-12355# Joint Publications Research Service, Washington, D. C.

SOME PROSPECTS IN FUNCTIONAL SIMULATION OF NERVE ELEMENTS AND SYSTEMS

V. G. Chervov and Yu. P. Bugay *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 70–73 refs (See N67-12341 03-05) CFSTI: $4.00

The construction of mathematical and electronic models of the neuron is discussed, and the mechanisms of excitation and inhibition are considered in detail. It is stated that, in order to create adequate models of the neuron, more neurophysiological information must be utilized. The parameters of the nerve tissue could be reproduced by comparatively accessible means, if the internal processes of the nerve cell are used as a starting point. L.E.W.

N67-12358# Joint Publications Research Service, Washington, D. C.

THE CONSTRUCTION OF MODELS OF NEURON GROUPS

V. I. Bazdyrev and V. G. Chervov *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 85–86 (See N67-12341 03-05) CFSTI: $4.00

Problems involved in constructing and investigating models of neuron groups, which are a combination of neurons executing a determinate function, are discussed. It is pointed out that simulation of neuron groups includes construction of known electrical, logical systems using new elements (neuron models) to create new principles for constructing control systems. Two examples of the application of neuron models in the construction of models of neuron groups are given, i.e., a neuron pulse counter and a neuron impulse oscillator. L.E.W.

N67-12359# Joint Publications Research Service, Washington, D. C.

A BIONIC MODEL OF COLOR VISION OF MAN AND SOME PROBLEMS IN THE THEORY OF COLOR TELEVISION

Yu. D. Shabanov-Kushnirenko and Ye. P. Putyatin *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 87–92 refs (See N67-12341 03-05) CFSTI: $4.00

A mathematical model of homogeneous standard visual processes was constructed using data obtained from psychophysiology of color vision in man, and the problems related to the isolation of signals with color in the communications channel of a color television are discussed. The following phenomena of color vision are discussed: color irradiation including variation in color sensation with a decrease in the angular dimensions of the observed object, sequential color contrast, simultaneous color contrast, and the Betsold–Bryukke phenomenon, which establishes that color tones of the objects change with variation in their radial brightness. Coefficients of the vision model were defined, and it was found that the basis for selection of the axes I and Q for encoding the color information does not withstand criticism from the viewpoint of the bionic model of vision. L.E.W.

N67-12360# Joint Publications Research Service, Washington, D. C.

THE USE OF A COMPUTER TO PROCESS INFORMATION OBTAINED FROM ANY POINTS OF ORGANISM CONTROL LOOPS

R. K. Kosinskiy *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 93–129 refs (See N67-12341 03-05) CFSTI: $4.00

Various attempts made to use a computer for analyzing biocurrents of the nervous system are reported, and the development of algorithms for the construction of programs is discussed. On the basis of one of the algorithms, a method for obtaining an autocorrelation function characterizing the frequency composition of the analyzed segment of an EEG was proposed. The use, structure, and capabilities of the algorithm are described in detail. L.E.W.

N67-12361# Human Factors Research, Inc., Santa Barbara, Calif.

GEOGRAPHIC ORIENTATION IN AIRCRAFT PILOTS: SPEED CONTROL INVERSION

James J. Mc Grath, Paul R. Christensen, and William E. Osterhoff Jul. 1966 44 p refs

(Contract Nonr-4218(00))

(TR-751-7; AD-638979) CFSTI: HC $2.00/MF $0.50

An experiment was conducted to investigate the incidence of inversion errors in the control of airspeed. Sixteen pilots were tested in a laboratory task that required them to make speed control decisions similar to those made during flight for the purpose of achieving a preplanned time of arrival. The results showed that pilots had little difficulty in deciding whether or not a change in speed was necessary, but frequently made errors in deciding which direction to change it. That is, pilots often decided to decrease speed when the correct response was to increase speed, and vice versa. The question of whether or not inversion

errors in speed control occur during actual flight is discussed, and some of the factors that may influence the occurrence of such errors are examined. Author (TAB)

N67-12363# Naval Personnel Research Activity, San Diego, Calif.
AN EVALUATION OF A SHORT FORM OF THE RADIO CODE APTITUDE TEST
Bernard Rimland Aug. 1966 11 p refs
(SRR-67-2; AD-639224) CFSTI: HC $1.00/MF $0.50

The radio code aptitude test (RCAT) has been used during and since WWII in the selection of personnel for Morse code training. As a result of recent criticism that the test was too highly speeded toward the end, and was thus hopelessly outpacing and demotivating the testees, an analysis was made of the feasibility of eliminating most of the fast-paced latter items of the RCAT. Statistical analysis of a sample of completed RCAT answer sheets showed the final sixty items (40 per cent) of the RCAT could be eliminated with no loss in psychometric efficiency. The short (60 per cent) form correlated .96 with the long form, and each form had a reliability of .95. Since most items unanswered by the testees were found to have occurred in the final, highly-speeded 40 per cent of the test, it may be assumed that testee frustration will be greatly reduced by the shortened RCAT. It is recommended that items 166 through 225 be omitted from future testing with the radio code aptitude test. A conversion table for obtaining Navy Standard scores from the new short form RCAT is provided. Author (TAB)

N67-12448# Stanford Univ., Calif. Dept. of Radiology.
MODIFICATION OF THE WOLFE INTEGRATING MOTOR PNEUMOTACHOGRAPH FOR ARCTIC USE
John C. Klopping *In* Aerospace Med. Div. AAL Nutritional Requirements for Survival in the Cold and at Altitude 1965 p 195–208 refs (See N67-12441 03-04) CFSTI: HC $7.00/MF $1.75
(Contract AF 41(657)-364)

Modifications to prevent freezing in arctic temperatures are reported for the pneumotachograph, an instrument for measuring the energy expended by man over long periods. C.T.C.

N67-12472# Aeronautical Research Labs., Melbourne (Australia).
THE INDIRECT MEASUREMENT OF TASK DIFFICULTY Human Engineering Report No. 4
E. Linden Hilgendorf Oct. 1965 30 p refs
(ARL/HE-4) CFSTI: HC $2.00/MF $0.50

The four experiments are concerned with the development of a technique for the measurement of complex and skilled tasks in terms of information theory. Performance on a key pressing task of varied information input was related to the spare mental capacity of the operator by measuring his performance on a secondary task. It was found that a sensory threshold task was unsuitable for this purpose but that a secondary attention task was lawfully related to information input on the primary task. It appears that a secondary task which is suitable for the measurement of spare mental capacity must satisfy several specified criteria. Author

N67-12494# Library of Congress, Washington, D. C. Aerospace Technology Div.
SOVIET HIGH-ALTITUDE EQUIPMENT FOR AIRCREW PROTECTION Surveys of Foreign Scientific and Technical Literature
Danial M. Pyle and Janice Smith 9 Jun. 1966 86 p refs
Special extended abstract and transl.
(ATD-66-67)

CONTENTS:

1. G-SUITS, PRESSURE SUITS AND PROTECTIVE HELMETS. ACCELERATIONS DURING PARACHUTE JUMPS S. refs (See N67-12495 03-05)

2. PROTECTIVE EQUIPMENT FOR HIGH-ALTITUDE FLIGHTS S. P. Umanskiy p 45–51 (See N67-12496 03-05)

3. PRESSURIZED CABINS M. F. Rebrov p 52–62 (See N67-12497 03-05)

4. HIGH ALTITUDE INSTRUMENTATION AND EQUIPMENT FAILURE I. G. Rabkin p 63–65 (See N67-12498 03-05)

5. HERMETICALLY SEALED HULL COMPARTMENTS AND METHODS OF CALCULATING THEIR STRENGTH B. L. Bel'skiy, I. P. Vlasov, V. N. Zaytsev, S. N. Kan, V. P. Karnozhitskiy et al p 66–72 (See N67-12499 03-02)

6. HIGH ALTITUDE EQUIPMENT Ye. V. Sofronov p 73–75 (See N67-12500 03-02)

N67-12495# Library of Congress, Washington, D. C. Aerospace Technology Div.
G-SUITS, PRESSURE SUITS AND PROTECTIVE HELMETS. ACCELERATIONS DURING PARACHUTE JUMPS
S. P. Umanskiy *In its* Soviet High-altitude Equipment for Aircrew Protec. 9 Jun. 1966 p 1–44 refs Transl. into ENGLISH of chap. 4 and 5 from the book "Bar'yer Vynosilivosti Letchika" Moscow, Izd-vo "Mashinostr." (See N67-12494 03-05)

General information is presented on the protective gear and devices designed to safeguard the pilot from acceleration during flight or during ejection. The development of G-suits with multiple bladders and pressure suits with constricting mechanisms is traced, and the main physiological effects of each are discussed. Construction of each type is detailed; schematic representations are included. The main components of protective aviation helmets are examined, the strength characteristics of typical helmet materials are compared, and the relative merits of the various types are assessed. Accelerations during emergency escape are considered in relation to parachute jumps and ejection devices. Design details are given, with emphasis focused on the ejection mechanisms necessitated by high speed aircraft. Also discussed are pilot exposure to acceleration during firing, windblast, airstream deceleration, negative lift, and angular acceleration; their effects on the human body; and the protection which the various devices afford. M.G.J.

N67-12496# Library of Congress, Washington, D. C. Aerospace Technology Div.
PROTECTIVE EQUIPMENT FOR HIGH-ALTITUDE FLIGHTS
S. P. Umanskiy *In its* Soviet High-altitude Equipment for Aircrew Protec. 9 Jun. 1966 p 45–51 Transl. into ENGLISH from Vestn. Vozdushnogo Flota (USSR), no. 4, 1958 p 64–68 (See N67-12494 03-05)

The problems of maintaining the normal vital activities of the human body during high altitude flights are considered in relation to the various solutions which have been devised. The conditions causing oxygen insufficiency are examined, along with the physiological changes which such insufficiencies induce. The use of pressurized cabins and of stationary oxygen installations is discussed, and details are given on the various oxygen mask designs, the altitude compensating or pressure suits, and the pressurized high altitude suits. M.G.J.

N67-12497# Library of Congress, Washington, D. C. Aerospace Technology Div.
PRESSURIZED CABINS
M. F. Rebrov *In its* Soviet High-altitude Equipment for Aircrew Protec. 9 Jun. 1966 p 52–62 Transl. into ENGLISH from "Chto Delayut Avtomaty na Samolete" Moscow, Voyenizdat, 1960 p 119–131 (See N67-12494 03-05)

Details are given on a ventilation-type pressurized cabin, in which air is supplied by the engine compressor at altitudes above 2000 to 2500 m. A schematic diagram showing the automatic equipment which comprises the system is included, and the function of each is briefly described. These include the compressor, automatic air feed regulator, check valve, heat exchanger, atmospheric air collector, humidity regulator and indicator, filter, flow meter

sensor, manual pressure control valve, air outlets, pressure regulator, altitude and pressure drop indicator, pressure loss alarm, external check valve, air duct system, emergency pressure venting valve, thermostat, flow meter indicator, and altitude signal. Also described are the various types of oxygen equipment carried for emergency use, such as oxygen apparatus with intermittent feed, and a device for creating excess pressure in oxygen masks. The protection afforded by an altitude compensating suit is assessed. M.G.J.

N67-12498# Library of Congress, Washington, D. C. Aerospace Technology Div.
HIGH-ALTITUDE INSTRUMENTATION AND EQUIPMENT FAILURE
I. G. Rabkin *In its* Soviet High-altitude Equipment for Aircrew Protec. 9 Jun. 1966 p 63–65 Transl. into ENGLISH from "Bezopasnosti Poletov" Moscow, Voyenizdat, 1962 p 88–91 (See N67-12494 03-05)

Instrument detection of depressurization or oxygen failure in a ventilation-type pressurized cabin is described, and the steps which must be taken to minimize the danger of hypoxia are discussed. The recommended sequence consists of switching on the emergency oxygen supply system, or switching over to feeding from the parachute device; a quick descent to a safe flight altitude (4000 m); and ascertaining that the system valve is completely open and that the air intake lever is correctly set. For stratospheric flights, high altitude equipment includes the parachute oxygen device, a pressurized helmet, and a pressurized flying suit. Speed in switching over to the oxygen supply is emphasized, as the reserve time during which a person can maintain efficiency without oxygen at 16,000 to 20,000 m is estimated at 8 to 10 seconds. A strong recommendation is made for preflight adjustment of all high altitude equipment. M.G.J.

N67-12641*# Harvard School of Public Health, Boston, Mass.
STUDY OF SPACE CABIN ATMOSPHERES Status Report, 1 Jan.–30 Jun. 1966
William A. Burgess and Parker Cramer Reist 30 Sep. 1966 27 p refs
(Grant NGR-22-007-053)
(NASA-CR-79538) CFSTI: HC $2.00/MF $0.50 CSCL 06K

CONTENTS:

1. SIZE DISTRIBUTION SAMPLING ERRORS INTRODUCED BY THE POINT-PLANE ELECTROSTATIC PRECIPITATOR SAMPLING DEVICE P. C. Reist 19 p refs (See N67-12642 03-05)

N67-12642*# Harvard School of Public Health, Boston, Mass. Dept. of Industrial Hygiene.
SIZE DISTRIBUTION SAMPLING ERRORS INTRODUCED BY THE POINT-PLANE ELECTROSTATIC PRECIPITATOR SAMPLING DEVICE
Parker Cramer Reist *In its* Study of Space Cabin Atmospheres 30 Sep. 1966 19 p refs (See N67-12641 03-05) CFSTI: HC $2.00/MF $0.50

In using the point plane electrostatic precipitator it is generally assumed that the size distribution of the sample collected represents reasonably well the actual particle size distribution of the test aerosol. This paper reports an investigation made to determine the accuracy of this assumption and concludes that for count size distributions the error introduced by this sampling device is insignificant. Author

N67-12870# Naval Research Lab., Washington, D. C.
METHOD FOR ON-SITE DETERMINATION OF RESIDUAL ADSORPTIVE CAPACITY OF CHARCOALS USED IN CLOSED ENVIRONMENTAL SYSTEMS
D. L. Venezky and W. B. Moniz 31 Aug. 1966 21 p refs
(NRL-MEMO-1710; AD-639145) CFSTI: HC $1.00/MF $0.50

The relationship between the moisture content of adsorbent-type charcoals and their residual adsorptive capacity for organic compounds was studied. Investigation of fourteen charcoal samples from submarine main-carbon filters has shown that the moisture content of the charcoals correlates with the organic loading previously determined by a steam desorption method. A simple apparatus for determining the moisture content of a charcoal sample was devised. The on-site determination of the residual adsorptive capacity of main-filter charcoals is suggested by the low cost of the closed-loop apparatus and the simplicity of the method. Since seventy percent of the charcoal samples which were investigated had more than half of their adsorptive capacity remaining, substantial savings should result. TAB

N67-12671# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
MECHANICAL IMPEDANCE AS A TOOL IN BIOMECHANICS Final Report, Jul. 1963–Jul. 1964
Edmund B. Weis, Jr., Neville P. Clarke, and Henning E. Von Gierke Jun. 1966 30 p refs
(AMRL-TR-66-84; AD-638792) CFSTI: HC $2.00/MF $0.50

The report presents new measurements of mechanical impedance in the transient acceleration environment and compares the results with previous measurements made in the steady state sinusoidal acceleration environment. Although there are some discrepancies which await further clarification, the transfer function obtained under these two environments show encouraging general correlation. With further sophistication of the method, the transient impedance measurement shows considerable potential in that a single test furnishes data over a spectrum of frequencies and provides a more general excitation condition. Although it has only been recently employed for this purpose, the practical usefulness of the impedance method as a means of establishing design criteria for protection systems is most encouraging. With further definition of the mechanodynamic properties of the body of protection system components, it appears reasonable that biomechanics can achieve the goal of providing optimized protection against the increasingly severe mechanical environments generated in aerospace vehicles and ground-transportation. Author (TAB)

N67-12696# Joint Publications Research Service, Washington, D. C.
THE PHYSICO-CHEMICAL MODELING OF INFORMATION AND THOUGHT PROCESSES
N. I. Kobozev 22 Nov. 1966 44 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 40, no. 2, 4, Feb.–Apr. 1966 (JPRS-38760; TT-66-35184) CFSTI: $2.00

CONTENTS:

1. THE PHYSICO-CHEMICAL MODELING OF INFORMATION AND THOUGHT PROCESSES I: THERMODYNAMICS OF INFORMATION PROCESSES N. I. Kobozev p 1–23 refs (See N67-12697 03-05)

2. THE PHYSICO-CHEMICAL MODELING OF INFORMATION AND THOUGHT PROCESSES II: THERMODYNAMICS OF THOUGHT PROCESSES N. I. Kobozev p 24–40 refs (See N67-12698 03-05)

N67-12897# Joint Publications Research Service, Washington, D. C.
THE PHYSICO-CHEMICAL MODELING OF INFORMATION AND THOUGHT PROCESSES. I: THERMODYNAMICS OF INFORMATION PROCESSES
N. I. Kobozev *In its* The Physico-Chem. Modeling of Inform. and Thought Processes 22 Nov. 1966 p 1–23 refs (See N67-12696 03-05) CFSTI: $2.00

The applicability of physical chemistry in the development of thermodynamical information models is illustrated using an ideal gas consisting of identical and immutable particle-chances compressed within a single cell. It is shown that, on the basis of this model, the realization of the information process at the molecular level is

thermodynamically permissible and does not require conditions which could not be physically satisfied for molecular systems. The transition to the chemical thermodynamics is associated with the change in number and kind of the originally introduced particle-chance and represents an essential extension of the thermodynamical information model to a more general case. This generalization leads directly to the thermodynamics of thinking. S.C.W.

N67-12698# Joint Publications Research Service, Washington, D. C.

THE PHYSICO-CHEMICAL MODELING OF INFORMATION AND THOUGHT PROCESSES II: THERMODYNAMICS OF THOUGHT PROCESSES

N. I. Kobozev *In its* The Physico-Chem. Modeling of Inform. and Thought Processes 22 Nov. 1966 p 24–40 refs (See N67-12696 03-05) CFSTI: $2.00

A thermodynamical model of logical thinking is derived in an attempt to establish those physico-chemical conditions which must be satisfied by the molecular mechanisms of thinking. Basic differences between the processes involved in the thermodynamical modeling of information and thinking are analyzed. Results of this investigation are as follows: (1) Information can be thermodynamically derived from thinking as its specific and simplest entropy form capable of being realized by molecular mechanisms; an inverse event cannot take place. (2) The condition that the given problem appears as a logical rather than an information one is the thermodynamical relationship $J_{Wien} < < \Delta\phi^{\circ} > 0$ and, correspondingly, $L > 0$. (3) The transition to the rigorously logical single-valued thinking corresponds to the transition to the limiting thermodynamical conditions $T = 0$ and $H_k = 0$, which corresponds to a complete freeing of the thought process from the molecular statistics. (4) Thinking cannot be materialized by means of ordinary molecular mechanisms, but must be necessarily connected with special mechanisms and special particles which are not obeying molecular statistics and may achieve the entropyless status without the temperature condition $T = 0$. S.C.W.

N67-12792 Joint Publications Research Service, Washington, D. C.

BIONICS AND THE PROBLEMS OF INSTRUMENTATION

V. Ye. Manoylov *In its* Izv. VUZov: Inst. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 145–147 (See N67-12761 03-14) CFSTI: $5.00

Some reports presented at a conference on bionics are briefly summarized. The topics covered by the reports include receptors, analyzers, and identification of forms; neuron organization and bionic systems of reliability; bionic aspects of control, adjustment, and man–machine systems; orientation and navigation of animals and birds; and biomechanics and bioenergetics. The necessity of developing accurate measuring instruments was pointed out. L.E.W.

N67-12821# Joint Publications Research Service, Washington, D. C.

NEWS OF SOVIET AVIATION AND COSMONAUTICS

1 Dec. 1966 25 p Transl. into ENGLISH from Aviats. i Kosmonavtika (Moscow), no. 8, 1966
(JPRS-38906; TT-66-35330) CFSTI: $1.00

CONTENTS:

1. ROUTINE OF SOVIET LONG-RANGE INTER-CONTINENTAL STRATEGIC MISSILE-CARRIER DESCRIBED O. Nazarov p 1–10 (See N67-12822 03-05)
2. COSMONAUT POPOVICH DESCRIBES THE VIEW OF THE EARTH FROM OUTER SPACE P. Popovich p 11–15 (See N67-12823 03-05)
3. ASPECTS OF FLIGHT TRAINING Z. Estrin p 16–19
4. NEW AUTOPILOT INSPECTING APPARATUS DEVELOPED A. Kalashnikov p 20–21

N67-12822# Joint Publications Research Service, Washington, D. C.

ROUTINE OF SOVIET LONG-RANGE INTERCONTINENTAL STATEGIC MISSILE-CARRIER DESCRIBED

O. Nazarov *In its* News of Soviet Aviation and Cosmonautics 1 Dec. 1966 p 1–10 (See N67-12821 03-05) CFSTI: $1.00

A crew member describes his impressions during a routine flight onboard a Soviet long range strategic missile carrier jet aircraft. R.N.A.

N67-12823# Joint Publications Research Service, Washington, D. C.

COSMONAUT POPOVICH DESCRIBES THE VIEW OF THE EARTH FROM OUTER SPACE

P. Popovich *In its* News of Soviet Aviation and Cosmonautics 1 Dec. 1966 p 11–15 (See N67-12821 03-05) CFSTI: $1.00

Descriptions of the earth as seen from space by both Soviet and American astronauts are given. The phenomenon of improved keenness of sight due to weightlessness and man's usefulness in photographing and observing the earth from spacecraft are briefly discussed. R.N.A.

N67-12921*# Case Inst. of Tech., Cleveland, Ohio. Solid State Electronics Lab.

[INVESTIGATION OF IMPLANTABLE MULTICHANNEL BIOTELEMETRY SYSTEMS] Semiannual Report, Mar. 1–Aug. 31, 1966

Wen H. Ko and William L. Thompson 15 Sep. 1966 19 p refs
(Grant NGR-36-003-079)
(NASA-CR-79728) CFSTI: HC $1.00/MF $0.50 CSCL 06B

Application of advanced electronic technology to the development of integrated circuit multiplexed telemetry systems for biomedical use is discussed. Multiplexing and demultiplexing circuitry for a three-channel system are described and studies of oscillators for the rf carrier of this multiplexing system including crystal controlled types are reported. Two types of oscillators are evaluated and compared: a single transistor noncrystal–controlled oscillator and an amplitude–modulated crystal controlled oscillator. The biomedical telemetry system is discussed with respect to the power supply and the transistor FM transmitters suitable for multiplex biotelemetry. S.P.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N67-12364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HERALD OF LENINGRAD UNIVERSITY PHYSICS AND CHEMISTRY SERIES

P. P. Pavinskiy and A. V. Storonkin, ed. 13 Apr. 1966 226 p refs Transl. into ENGLISH of Vestn. Leningr. Univ., Ser. Fiz. i Khim. (Leningrad), issue 3, no. 16, 1963 p 1–136
(FTD-MT-64-222; TT-66-62150; AD-638172) CFSTI: HC $6.00/MF $1.25

Journal articles on solid state physics, electronics, physical chemistry, and electrochemistry are presented. For individual titles see N67-12365–N67-12386.

N67-12369# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF FREE ELECTRONS METHOD TO STUDY OF HYPERCONJUGATION EFFECT

M. N. Adamov and I. F. Tupitsin *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 61–69 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

Applications of the free electron method to study the electron structure and the spectra of hyper conjugate methylbenzene molecules are surveyed. Several models were investigated in the extension of this method to the calculation of hyperconjugation effects in substituted aromatic hydrocarbons. For compounds of toluene, o-xylene, m-xylene, and p-xylene, results of calculations of certain alkyl benzene molecules, according to the inductive model, are presented; and, it is seen that the partial rate factor for ortho substitution in toluene should somewhat exceed that for para substitution. Also tabulated are the results of calculations in toluene molecules by the inductive, heterostomic, and vinylbenzene approximation models. Simple and stepped metal models with the potential sources of the δ-function type were used. R.U.

N67-12370# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATIONS ON THE WATER MOLECULE IN THE ONE-CENTER APPROXIMATION

Ye. M. Ledovskaya *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 70–74 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

A calculation was effected of the water molecule in a one-center approximation when taking molecular symmetry into account. The directed molecular orbits were constructed from the oxygen Slater-type s, p, and d-functions. Orbital coefficients were determined from the variational principle for the energy. The system of equations for the coefficients was solved by the gradient method. The calculated value of the energy was found to be in good agreement with experimental work. R.U.

N67-12372# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECTROSCOPIC DETERMINATION OF ISOTOPIC COMPOSITION OF NITROGEN

G. S. Lazeyeva, A. A. Petrov, and V. V. Fedorov *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 82–89 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

Spectral isotope analysis of nitrogen was carried out with pure mixtures of ^{14}N and ^{15}N isotopes. The analysis made use of band heads of a N_2 molecule with positive and negative isotopic shift, and the spectrum was registered photoelectrically. The dependence of the results upon experimental conditions is explained as due to the change of the rotational temperature. R.U.

N67-12373# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ISOTOPE SPECTRAL ANALYSIS OF BORON

A. G. Zhiglinsky and A. S. Kochemirovsky *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 90–99 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

Spectral analysis methods are outlined to determine the isotopic composition of boron by emission spectroscopy of BO molecules, and by the atomic spectrum. Since stable isotopes of ^{11}B and ^{10}B possess sharply different neutron absorption capacities, they are of interest in solving certain problems in nucleonics. Analysis by molecular spectrum is also suggested. The photographic method of spectrum registration is briefly detailed, and the analysis performed by means of calibration graphs. The relative error reported in determining the isotope presence is about 2–5% in the atomic spectrum analysis, and 2–3% in the molecular spectrum analysis. R.U.

N67-12375# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF THE SURFACE CONDUCTIVITY AS A FUNCTION OF TEMPERATURE, COMPOSITION OF SOLUTION AND ITS CONCENTRATION

Lin Guan Tsan and D. A. Fridrikhsberg *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 118–132 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

Several chloride solutions, in the temperature range of 20° to 50°C, were measured on different diaphragms and membranes for surface conductance. Some conclusions reported are: (1) Surface conductivity increased with an increase of the concentration on polar surfaces, and decreased on weakly polar surfaces. (2) The activation energy of ions in a double layer often exceeded such in a free solution of 0.5 to 1.0 kcal/mole. (3) The mobility of ions in the layer adjacent to the wall was significant and constituted about 50% of the mobility in free solution, with the exception of cases of specific absorption. It is indicated that the conductance concentration variations depend on the polarity of the surface. R.U.

N67-12376# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF THE ELECTROKINETIC POTENTIAL AS A FUNCTION OF TEMPERATURE, COMPOSITION OF SOLUTION AND ITS CONCENTRATION

Lin Guan Tsan and D. A. Fridrikhsberg *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 133–141 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

To obtain the electrokinetic potential, different electrolyte solutions on cellophane and collodion membranes, and ceramic diaphragms were measured. Values of surface charge density increase with an increase of the electrolyte concentration, and the nature of change may be explained by adsorption of ions from solution. In $AlCl_3$ solutions, the change in the charge sign is observed due to specific adsorption of the cation on ceramics. In the case of HCl, the absolute values of the electrokinetic potential and the free charge decrease as the temperature increases. This anomalous behavior is accounted for by the desorption of H^+ ions from the surface. R.U.

N67-12377# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMODYNAMIC PROPERTIES OF THE AgCl–NaCl–$PbCl_2$ SYSTEM. II: ACTIVITIES AND ACTIVITY COEFFICIENTS OF THE COMPONENTS OF THE SYSTEM FOR THE SOLID PHASE OF VARIABLE COMPOSITION

A. A. Nazarov, M. M. Shultz, and A. V. Storonkin *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 142–156 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

The electromotive forces of chemical circuits during the change of the composition of the electrolyte by the solubility isotherms of AgCl–NaCl solid solutions are measured by a galvanic cell, in relation to an investigation of the thermodynamic properties of the AgCl–NaCl–$PbCl_2$ system. Positive deviation from the ideal behavior of a solid solution was noted. R.U.

N67-12378# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GALVANOSTATIC STUDY OF ELECTRODEPOSITION PROCESSES AND ANODE DISSOLUTION OF ZINC IN ZINC PERCHLORATE SOLUTION

V. I. Kravtsov and G. V. Zverevich *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 157–169 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

The processes of deposition and dissolution of zinc were investigated by the galvanostatic method. It was established that the rates of zinc deposition and dissolution processes are independent of the pH-value of the solution and are determined by the rate discharge-ionization. Transfer coefficients and exchange current were determined from cathodic and anodic ϕ–log i curves. R.U.

N67-12379# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE CHANGE OF ELECTRONIC ABSORPTION SPECTRA UPON ADDITION OF INDIFFERENT SUBSTANCES

V. V. Pal'chevskiy and B. S. Smolyakov *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 170–179 refs (See N67-12364 03-06) CFSTI: HC$6.00/MF$1.25

The change of the electron absorption spectra of solvated anions under the influence of some indifferent substances (electrolytes and nonelectrolytes) was surveyed. It is stated that the invariability of absorption spectra of the anion during the introduction of such substances into the solution indicates that the change of interaction of absorbing anion does not take place. R.U.

N67-12380# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF EXCHANGE CONSTANTS OF CERTAIN ANIONS ON ANIONITES

V. I. Paramonova, A. N. Mosevich, and J. G. Zonov *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 180–187 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

The values of interchange constants for CH_3COO^-–NO_3^-, CH_3COO^-, $UO_2(CH_3COO)_3^-$, NO_3^-, $UO_2(CH_3COO)_3^-$ anions on anionic resins EDE-10P and AV-17 were obtained. The anions in respect to their affinity with the resins form the following sequence: $UO_2(CH_3COO)_3^- > CH_3COO^- > NO_3^-$. This sequence is valid for both anion-exchangers, but the difference in absorption for the resin AV-17 is more marked than for EDE-10P. Author

N67-12381# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF STRUCTURE OF POLYMERS BY THE MOLCAO METHOD

N. P. Borisova and L. P. Bokacheva *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 188–199 refs (See N67-12364 03-06) CFSTI: HC$6.00/MF$1.25

The indexes of reactivity (the energy of hyperdelocalization in transition state, and the conjugation energy difference of initial and final states) were calculated for reactions of radical polymerization of butadiene, chloroprene, and their copolymerization. Both gave similar qualitative results, and the most probable structures of the polymers formed were determined. The reaction of polymer branching was considered, and a small constant of action was obtained experimentally. Calculations of both methods are compared, and their applications discussed. R.U.

N67-12383# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMODYNAMICS OF FERROUS OXIDE

M. S. Yakovlev and S. M. Ariya *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 208–211 refs (See N67-12364 03-06) CFSTI: HC$6.00/MF$1.25

A study of thermodynamics of FeO was conducted to clarify the possibility of considering this compound as a thermal solid solution of some iron oxides. The emf values of cells are tabulated, and composition of the electrode is indicated. By emf measurements of galvanic cells containing FeO it was shown that FeO is not a thermal solid solution of two iron oxides. S.P

N67-12384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DIFFERENTIAL THERMAL ANALYSIS OF $RbCl\text{-}NbOCl_3$ AND $CsCl\text{-}NbOCl_3$ SYSTEMS

S. A. Shchukarev, Ye. K. Smirnova, and I. V. Vasil'kova *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 212–214 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

Interactions of the niobium oxytrichloride melt with rubidium and cesium chlorides were studied by differential thermal analysis. Thermograms were taken in the 300–800°C region, and three types of compounds were observed. It was found that the compound $RbCl\text{-}NbOCl_3$ melts congruently at 526°C and $CsCl\text{-}NbOCl_3$ melts incongruently at 455°C. Formed in solid state are the compounds $3RbCl\text{-}NbOCl_3$ and $3CsCl\text{-}NbOCl_3$ which are decomposed at above 546° and 520°C respectively. S.P.

N67-12385# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMODYNAMIC STUDY OF DICHLORIDES AND TRICHLORIDES OF RARE-EARTH ELEMENTS

O. G. Polyachenok and G. I. Novikov *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 215–216 ref (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

Some thermodynamic characteristics of the evaporation of rare earth di- and trichlorides are tabulated. Standard enthalpies of the formation of some dichlorides are calculated from dissociation pressure measurements and from the solubility of metals in their molton trichlorides. S.P.

N67-12386# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AMPEROMETRIC DETERMINATION OF THORIUM WITH THORON

I. A. Tserkovnitskaya and Ye. Zhu-Tszyu *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 217–220 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

A method for defining thorium contents in monazite by thoron titration is suggested. The possibility of amperometric titration of thorium by the organic dye thoron, which forms an insoluble compound with thorium, is investigated. The polarographic behavior of thoron is discussed, and conditions are developed for amperometric titration. S.P.

N67-12397# Barcelona Univ. (Spain).

SYNTHESIS, STRUCTURE, AND CONFIGURATION OF SOME MACROMOLECULAR CHLOROCARBONS OF HIGH THERMAL AND CHEMICAL STABILITY

Manuel Ballester, Juan Castaner, and Juan Riera Wright-Patterson AFB, Ohio, ARL, 5 Mar. 1966 8 p refs Repr. from J. Am. Chem. Soc., v. 88, 1966 p 957–963 (ARL-66-0080; AD-634712)

The syntheses of three macromolecular chlorocarbons (perchloropoly-p-xylenediylidene (PP-xynene), $(C_8Cl_6)m$; perchloropoly-p-dipropencyl benzenediylidene (PP-diprobene), $(C_{12}Cl_{10})m$; and perchloropolybi-p-tolyldiylidene (PP-bitylene), $(C_{14}Cl_{10})m$) starting from perchloro-p-xylene, perchloro-1,4-dipropenylbenzenes, and perchlorobi-p-tolyl, respectively, are described and their structure and configuration studied. The mechanism of this polycondensation is discussed. These materials have an exceptionally high thermal stability (up to 500, incipient red heat) and chemical inertness. Author (TAB)

N67-12435# Joint Publications Research Service, Washington, D. C.

RESEARCH IN METALLOCOMPLEX CATALYSIS AND CARBONATE-BICARBONATE EQUILIBRIUM

17 Nov. 1966 18 p refs Transl. into ENGLISH from Russian (JPRS-38687; TT-66-35111) CFSTI: $1.00

CONTENTS:

1. CATALYTIC PROPERTIES OF SYSTEMS CONSISTING OF POWDERED METALS AND PHTHALOCYANINES S. D. Lavina et al p 1–7 refs (See N67-12436 03-06)
2. STUDY OF EQUILIBRIUM CARBONATE-BICARBONATE ELECTROLYTE IN THE PRESENCE OF POTASSIUM FORMATE L. A. Matusevich and V. S. Bagotskiy p 8–14 refs (See N67-12437 03-06)

N67-12436# Joint Publications Research Service, Washington, D. C.

CATALYTIC PROPERTIES OF SYSTEMS CONSISTING OF POWDERED METALS AND PHTHALOCYANINES

S. D. Lavina et al *In its* Res. in Metallocomplex Catalysis and Carbonate–Bicarbonate Equilibrium 17 Nov. 1966 p 1–7 refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 40, no. 6, 1966 p 1229–1233 (See N67-12435 03-06) CFSTI: $1.00

Results are presented of experiments with systems consisting of powdered metals, coated with a thin film of phthalocyanine of the same metal. Several reactions have been studied with catalysts consisting of powdered iron, copper, cobalt, and nickel. The rates of these reactions have been compared to determine the mechanism of the effect of phthalocyanine films on the catalytic properties of the metal–metal phthalocyanine systems. A.G.O.

N67-12437# Joint Publications Research Service, Washington, D. C.

STUDY OF EQUILIBRIUM CARBONATE–BICARBONATE ELECTROLYTE IN THE PRESENCE OF POTASSIUM FORMATE

L. A. Matusevich and V. S. Bagotskiy *In its* Res. in Metallocomplex Catalysis and Carbonate–Bicarbonate Equilibrium 17 Nov. 1966 p 8–14 refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), no. 7, 1966 p 1463–1467 (See N67-12435 03-06) CFSTI: $1.00

Results are presented from an investigation of the equilibrium in the carbonate–potassium bicarbonate system as a function of temperature, total solution concentration, and the amount of organic reducing agent (potassium formate) introduced into the system. It was established that the overall concentration of solutions has no large effect on the concentration of the OH^- ions, especially at a temperature of 90°C and higher. A.G.O.

N67-12530# Western Ontario Univ., London. Dept. of Chemistry.

THE PHOTOCHEMISTRY OF UNSATURATED SYSTEMS CONTAINING HETERO ATOMS OTHER THAN OXYGEN Final Report, Sep. 1965–May 1966

P. De Mayo May 1966 10 p refs
(Grant DA-ARO(D)-31-124-G399)
(AROD-3869-4; AD-637397)

A summary is presented of a study of the products and mechanisms of reactions wherein unsaturated systems containing nitrogen or sulfur are photolyzed. Included are studies of the photochemical Beckmann rearrangement, the general heteroatom transfer, coumalin dimerization, and the photolytic decomposition of B-ketosulphones. Author

N67-12532# Boston Coll., Chestnut Hill, Mass.

A COMPARATIVE STUDY OF THE SPECTROCHEMICAL ANALYSIS OF A COPPER BASE SOLUTION BY THE INTENSITY LINE RATIO, THE LINE WIDTH AND THE AREA RATIO METHODS Final Report, 1 Oct. 1964–1 Apr. 1965

James J. Devlin and James F. Waterbury 23 Aug. 1965 66 p refs
(Contract AF 19(604)-8819)
(AFCRL-65-855, Pt. II; AD-631343) CFSTI: HC $3.00/MF $0.75

The precision of spectrochemical analysis declines in proportion to the increase in concentration of impurities for which an analysis is sought. This study endeavored to discover of it was possible to increase the precision for a copper base metal for higher percentages of lead, zinc and tin. A solution technique was followed since this at once offered the most reliable approach to preparing standards and because segregation opposes a reproducible result. Three methods of reducing the data of a large number of line pairs were followed, namely, the intensity ration, the line width and the integrated area ratio methods. The accumulated data shows little advantage to using the line width and the integrated ratio methods over the line intensity ratio method when lower concentrations are investigated. As the concentrations increase however, a marked decrease in the coefficient of variation results from using the integrated ratio method. This increase precision is accompanied by additional time and effort in preparing working curves. After a curve is established, on the other hand, the method consumes a little more time than presently used methods. Author (TAB)

N67-12836# Air Force Cambridge Research Labs., Bedford, Mass.

ULTRAPURE BORON FROM HALIDE INTERMEDIATES

A. F. Armington, J. T. Buford, and R. J. Starks (Eagle-Picher Co., Miami, Fla.) Mar. 1966 17 p refs Repr. from BORON, v 2 Prepn., Properties, and Appl., 1965 p 21–33 refs Prepared in Cooperation with Eagle-Picher Co. *Its* Phys. Sci. Res. Paper-207
(AFCRL-66-188; AD-631798)

The preparation, purification, and analysis of high-purity boron produced from iodide and bromide intermediates are discussed. The discussion begins with the preparation of these intermediates, predominantly from the elements. Of the several methods of purification considered, distillation appears to be the most satisfactory. Decomposition of boron and other substrates was performed using both hydrogen and vacuum procedures. In some cases, the final product was then zone-refined. Analytical results from emission and mass spectroscopy are given. Advantages and disadvantages of the bromide and iodide processes are compared. Author (TAB)

N67-12537# Frankford Arsenal, Philadelphia, Pa.

TRIFERROCENYLPHOSPHINE AND DIFERROCENYLPHOSPHINOUS CHLORIDE. NOVEL PREPARATION, AND CHARACTERIZATION

Gilbert P. Schiott and William R. Peterson, Jr. 1965 9 p refs Repr. from J. Organometal. Chem. (Amsterdam), v. 4, 1965 p 491–493 refs
(A65-13; AD-632101)

Triferrocenylphosphine and diferrocenylphosphinous chloride, compounds previously unknown, were prepared by the novel reaction of ferrocenet with N,N-diethylphosphoramidous dichloride in the presence of anhydrous aluminum chloride. The phosphine was converted to the sulfide and selenide, the phosphinous chloride to the secondary phosphine oxide. Author (TAB)

N67-12663# Naval Radiological Defense Lab., San Francisco, Calif.

RADIOACTIVITY RELEASE FROM RADIONUCLIDE POWER SOURCES. III: RELEASE FROM PLUTONIUM METAL TO SEAWATER

Ming G. Lai and Harry Goya 11 Jul. 1966 48 p refs
(Contract AT(4905)-2064)
(USNRDL-TR-1050; AD-638848) CFSTI: HC $2.00/MF $0.50

Plutonium metal reacts completely with natural seawater to produce solid reaction products, believed to be plutonium oxide and/or hydroxide, and a gaseous product whose major component is hydrogen. The mole ratio of plutonium metal reacted to hydrogen evolved is unity. The mixture resulting from the reaction of plutonium metal with seawater contains a non-uniform distribution of solids, and ionic and complexed species. In order to reproducibly sample this heterogeneous mixture an experimentally determined sampling procedure must be followed which produces uniform results. The maximum rate at which plutonium solid reaction products enter into solution in seawater is very slow, approximately 1.5 to 2 micrograms per day per 50–70 mg of solids in seawater. The effect of individual complexing anions on the solubility of the Pu solids was found to be additive. The equilibrium (or maximum) concentration of dissolved Pu in three samples of natural seawater was found to be 67 microgram/l. For seawater samples taken at different localities or at different times of the year, deviations from this value can be expected due to differences in the concentrations of complexing anions present. Author (TAB)

N67-12738# Houston Univ., Tex.

STUDIES IN EXPERIMENTAL ORGANIC COSMOCHEMISTRY

John Oro *In* NAS–NRC Extraterrest. Life 1966 p 226–243 refs Reprinted (See N67-12721 03-04) Available from NAS–NRC, Washington, D. C.: $6.00
(Grants NsG-257-62; NSF G-13117)

Models for the synthesis of organic processes and available energy sources are considered in relation to cosmic bodies, and the importance of space and planetary probes is stressed as the only means of ascertaining the correctness of present-day hypotheses. Experiments are reported on the synthesis of amino and hydroxy acids, monosaccharides, purines and purine intermediates, pyrimidines, polypeptides, and polynucleotides. It is concluded that if the earth protoplanet had some of the simple organic constituents of comets, a large number of these biochemical compounds would have been spontaneously synthesized during its development. The formation of complex biochemical compounds is not in disagreement with thermodynamic principles. In fact, these syntheses can occur because the initial precursors (nitriles, aldehydes, olefins, etc.) are high energy compounds that transform into biochemical compounds as they acquire lower energy states and stabilize. M.W.R.

N67-12798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFRARED SPECTRA OF VARIOUS METAL OXIDES IN THE REGION OF 2 TO 26 MICRONS
Dean W. Sheibley and Maurice H. Fowler Washington, NASA, Dec. 1966 64 p refs
(NASA-TN-D-3750) CFSTI: HC $2.50/MF $0.75 CSCL 07D

The infrared spectra of 52 metal oxides were determined through the sodium chloride and potassium bromide absorption regions. These spectra include the stable rare earth oxides and are the first comprehensive collection of infrared metal oxide spectra known to be published. Author

N67-12838# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYMPOSIUM ON PURE MATERIALS IN SCIENCE AND TECHNOLOGY [REINSTSTOFFE IN WISSENSCHAFT UND TECHNIK]
4 Apr. 1966 23 p refs Transl. into ENGLISH from GERMAN Symp. held Dresden, 30 Nov.–2 Dec. 1961
(FTD-TT-65-837; TT-66-61935; AD-636624) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. PREPARATION OF HIGHLY PURE BERYLLIUM OXIDE J. Kubala 5 p refs (See N67-12839 03-06)
2. SEPARATION OF TITANIUM, NIOBIUM, AND TANTALUM THROUGH LIQUID–LIQUID–EXTRACTION W. Baronius and W. Geidel p 6–17 refs (See N67-12840 03-06)

N67-12839# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PREPARATION OF HIGHLY PURE BERYLLIUM OXIDE
J. Kubala *In its* Symp. on Pure Mater. in Sci. and Technol. 4 Apr. 1966 5 p refs (See N67-12838 03-06) CFSTI: HC $1.00/MF $0.50

Procedures are described of a method for producing beryllium oxide of a sufficiently high purity for use in nuclear technology. R.N.A.

N67-12840# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEPARATION OF TITANIUM, NIOBIUM, AND TANTALUM THROUGH LIQUID–LIQUID–EXTRACTION
W. Baronius and W. Geidel *In its* Symp. on Pure Mater. in Sci. and Technol. 4 Apr. 1966 p 6–17 refs (See N67-12838 03-06) CFSTI: HC $1.00/MF $0.50

A brief summary is presented of experiments performed to find a technically suitable solvent system that would, by use of the liquid–liquid extraction method, permit the separation of niobium and tantalum from tantalum–niobium containing raw materials contaminated with titanium. The distribution quantities were used to calculate the theoretical number of separation stages as well as the height of the extraction columns required to achieve end products of certain degrees of purity. R.N.A.

N67-12848# Indian Inst. of Science, Bangalore. Dept. of Chemical Engineering.
THERMODYNAMIC PROPERTIES OF CARBON TETRACHLORIDE
D. N. Seshadri, D. S. Viswanath, and N. R. Kuloor *In its* J. of the Indian Inst. of Sci., vol. 48, no. 2 and 3 Jul. 1966 p 65–80 refs (See N67-12843 03-34) CFSTI: HC $3.00/MF $0.75

The thermodynamic properties of carbon tetrachloride have been calculated up to a temperature of 750°K and a pressure of 200 atmospheres, using an equation of state. Tables of thermodynamic properties and a temperature-entropy diagram are presented. Author

N67-12862# Iowa State Univ. of Science and Technology, Ames.
BIBLIOGRAPHY OF MASS SPECTROSCOPY LITERATURE, COMPILED BY COMPUTER METHOD
J. Capellan, H. J. Svec, and C. R. Sage Mar. 1966 399 p refs
(Contract W-7405-ENG-82)
(IS-1335) CFSTI: HC $4.25/MF $1.75

More than 1500 articles in the field of mass spectroscopy are listed as a result of computer searching of more than 340,000 scientific articles during late 1964, 1965, and early 1966. The 108 papers presented at the 13th Annual Conference on Mass Spectrometry and Allied Topics held in St. Louis, Missouri, May 16–25, 1965 are included in the listing. A bibliography, an author index, and a permuted title (KWIC) index are contained in the report. An explanation of how to use each section is presented. Author (NSA)

N67-12863# Battelle Memorial Inst., Columbus, Ohio.
RADIATION-INDUCED FORMATION OF ORGANOMETALLIC COMPOUNDS WITH PARTICULAR EMPHASIS ON ORGANOTINS
Allison F. Fentiman, Jr., Robert E. Wyant, James L. Mc Farling, E. Jack Kahler, and John F. Kircher 3 Jan. 1966 21 p refs
(Contract W-7405-ENG-92)
(BMI-1753) CFSTI: HC $2.00/MF $0.50

Effects of variables on the yield of alkyltin halides and product distribution were studied. Yields corresponding to a G-value greater than 10^3 were obtained with tin and 1-bromobutane under the best conditions. An activation energy of 30.8 kcal/mole was found for the tin/1-bromobutane system and 20 kcal/mole for tin/1-bromopentane system. It was further observed, for the tin/bromobutane reaction, that the G-value is proportional to $I^{-1/2}$, where I is the intensity of the radiation. Thus, at low dose rates very high G-values were obtained. The product distribution appears to depend only on the degree of conversion. At a conversion of less than 10 wt % of 1-bromobutane, the product contained about 90 wt % dibutyltin dibromide, whereas at a conversion of 60 wt %, the dibutyltin dibromide content dropped to about 80 wt %. The crude product can be purified by thermal disproportionation, yielding dibutyltin dibromide with a purity greater than 95%. The radio induced reaction of tin and the alkyl bromides appeared to be general, although the alkyl chlorides could not be made to react with tin under the radiation conditions examined. Author (NSA)

N67-12866# Los Alamos Scientific Lab., N. Mex.
LEACHING OF URANIUM BY HYDROGEN CHLORIDE FROM PYROLYTIC-CARBON-COATED URANIUM DICARBIDE BEADS
Maynard E. Smith, John H. Cappis, and Glenn R. Waterbury 6 Jul. 1966 32 p refs
(Contract W-7405-ENG-36)
(LA-3488) CFSTI: HC $2.00/MF $0.50

The corrosive action of HCl on pyrolytic-C-coated UC_2 beads was investigated over the range 1600 to 2100°C. It was necessary to develop an apparatus that could withstand the high temperature and the corrosive HCl–He mixture. A measured volume of the gas mixture was passed through each sample at temperatures ranging from 1600 to 2100°C. The UCl_4 vapor produced in the process was condensed, and the U determined spectrophotometrically. In the range from 1800 to 2100°C the relative standard deviations for median values of the amount of U leached varied from 4 to 21% for six or more determinations at any given temperature level for a single sample. The amount of U leached was greatly dependent on the temperature, which must be controlled rigorously. It was concluded that the rate-determining step in the leaching process was the diffusion of the U from the core of the bead through the pyrolytic C coating. Author (NSA)

N67-12870# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SULFUR DETERMINATION SUPPORTING THE WASTE SOLIDIFICATION PROGRAM
L. F. Lust and B. P. Van der Cook Jul. 1966 9 p refs
(Contract AT(45-1)-1830)
(BNWL-265) CFSTI: HC $1.00/MF $0.50

Combustion with vanadium pentoxide proved to be an effective method of separating sulfur from a complex matrix such as the solid product from the solidification of fission product wastes. After the sulfur has been volatilized from the sample in the form of sulfur trioxide, it is reduced to sulfur dioxide by hot copper turnings, removed from the off-gas stream, and quantitatively determined by titration or colorimetry. Absorption in an iodine solution and backtitration of the excess iodine is used in the range of 1 to 5 mg of sulfur. The error is approximately ±5%. A colorimetric determination employing pararosaniline hydrochloride and formaldehyde is used in the range 5 μg to 1 mg of sulfur with ±10% error. NSA

N67-12871# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY Progress Report, Dec. 1965
J. F. Eichelberger, G. R. Grove, and L. V. Jones 25 Jul. 1966 30 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1312) CFSTI: HC $2.00/MF $0.50

Developments are reported for studies on: alpha–beta branching ratio of actinium-227; carbon isotope separation by chemical exchange; neon, argon, krypton, and xenon isotope separations by thermal diffusion, krypton-xenon separation by chromatography; and molecular beam scattering, collision integrals, transport coefficients, transport properties, and cascade theory in thermal diffusion. NSA

N67-12972*# United Aircraft Corp., East Hartford, Conn.
ANALYTICAL STUDY OF CATALYTIC REACTORS FOR HYDRAZINE DECOMPOSITION Quarterly Progress Report, 15 Jul.–14 Oct. 1966
A. S. Kesten Oct. 1966 19 p refs
(Contract NAS7-458)
(NASA-CR-80336; E910461-6; QPR-2) CFSTI: HC $1.00/MF $0.50 CSCL 07A

A computer program representing the steady-state microscopic model of a distributed-feed catalytic reaction chamber was developed. This program provides for the simultaneous solution of the implicit integral equations describing reactant concentrations and temperature profiles in the porous catalyst particles, with the equations describing the variation of reactant concentrations and temperature with axial position in the interstitial phase. Test runs were made with the program as a whole and with the portion which treats simultaneous heat transfer, diffusion, and chemical reaction in the catalyst particles. A second program was written for the transient macroscopic model of a distributed-feed catalytic reaction chamber. Overall transport coefficients define the driving forces for heat and mass transfer in terms of the temperature and concentration differences between interstitial and gas phases in the interior of the catalyst particles. Differential equations for temperature and reactant concentrations were formulted and solved. K.W.

N67-12994*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
A STUDY OF GAS SOLUBILITIES AND TRANSPORT PROPERTIES IN FUEL CELL ELECTROLYTES Second Semiannual Report, Mar. 1–Aug. 31, 1966
Robert D. Walker, Jr. 7 Oct. 1966 29 p refs
(Grant NGR-10-005-022)
(NASA-CR-80376; SAR-2) CFSTI: HC $2.00/MF $0.50 CSCL 07D

Densities of KOH solutions up to 52 wt% KOH and 150°C were made using two techniques. Agreement is satisfactory with other available data. A modified technique is being explored for measuring higher temperatures and KOH concentrations. Vapor pressures over KOH solutions were measured for KOH concentrations up to 53 wt% and two atmospheres. Fair agreement was obtained with data reported in the literature, but the method appears unsuitable for measurements at very high KOH concentrations and temperatures. A method for concentrating dissolved gases before analysis was perfected and a few measurements were made of oxygen's solubility in KOH solutions at 25°C. These agree well with earlier data at low KOH concentrations and lie close to a straight line on a semi-log plot of solubility versus KOH concentration. Solubility data for 50°C also gave a linear semi-log solubility versus concentration plot. A new steady state diaphragm cell method was perfected for measuring diffusivities. It yields reasonably accurate rapid results and its adequacy was shown by determining the diffusivity of several hydrocarbons and CO_2 in water. Agreement with earlier reported results was good. R.N.A.

N67-13091# European Atomic Energy Community, Geel (Belgium). Central Bureau for Nuclear Measurements.
REVIEW OF TREATMENTS APPLIED TO ELECTRODES USED FOR POTENTIOMETRIC ANALYSIS (WITH PARTICULAR REFERENCE TO URANIUM) [REVUE DES TRAITEMENTS APPLIQUES AUX ELECTRODES UTILISEES POUR LES TITRAGES POTENTIOMETRIQUES (APPLICATION AU CAS PARTICULIER DE L'URANIUM)]
Y. Le Duigou Aug. 1966 11 p refs In FRENCH; ENGLISH summary
(EUR-3118.f) CFSTI: HC $1.00/MF $0.50

A literature review is given of different conditioning procedures applied to electrodes used in potentiometric end-point determinations with special references to uranium titrations. Author

N67-13138# National Bureau of Standards, Washington, D. C.
STANDARD X-RAY DIFFRACTION POWDER PATTERNS
Howard E. Swanson, Marlene C. Morris, and Eloise H. Evans 28 Jun. 1966 82 p refs
(NBS-Monograph-25, Sect. 4) GPO: $0.55

Standard x-ray diffraction powder data are presented for 103 substances. Thirty-two of these patterns represent experimental data and 71 are calculated. The experimental x-ray powder diffraction patterns were made with a Geiger counter x-ray diffractometer using samples of high purity. All *d*-values were assigned Miller indices determined by comparison with theoretical interplanar spacings and from space group extinctions. The densities and lattice constants were calculated, and the refractive indices were measured whenever possible. The calculated x-ray powder diffraction patterns were obtained from single crystal structure data. The reported peak height intensities for calculated patterns were converted from integrated intensities. Accurate cell determination measurements for the internal standards were obtained by using a flat-plate back reflection focusing camera. Author

N67-13158# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
SULFUR COMPOUND CHARACTERIZATION STUDIES ON HIGH-BOILING PETROLEUM FRACTIONS
Charles J. Thompson, N. G. Foster, H. J. Coleman, and H. T. Rall 1966 21 p refs
(BM-RI-6879)

This study describes the preparation of sulfur compound concentrates boiling from 225° to 400° C, and reports the sulfur types detected in these concentrates by low-voltage mass spectrometry. Existing LVMS methods were extended; the procedures described should be generally applicable to high-boiling petroleum distillates and concentrates as a preliminary means of narrowing the number of factions to be considered for more detailed separation and identification studies. The following major sulfur compound constituents of petroleum are indicated by the data: benzothiophenes, dibenzothiophenes, naphthanothiophenes, naphthenobenzothiophenes, and homologs and isomers of these. Cyclic and chain sulfides comprise a significant portion of the gas–oil range sulfur compound types. The presence of some classes of sulfur compounds containing two sulfur atoms per molecule was indicated. Author

N67-13192*# Franklin GNO Corp., West Palm Beach, Fla.
A FUNDAMENTAL STUDY OF ELECTROPHILIC GASES FOR PLASMA QUENCHING
Robert W. Crowe and W. D. Kilpatrick 15 Oct. 1966 82 p refs
(Contract NAS1-5575)
(NASA-CR-66206) CFSTI: HC $2.50/MF $0.75 CSCL 07D

The electron attachment properties of several high molecular weight gases were examined; calculations for quiescent plasma quenching have been made based on data from room temperature measurements. One measurement technique employed negative ions of these gases in a drift tube such that negative ion mobility could be measured. The mobilities of the negative ions for the gases in air at concentrations of 10 to 0.5% gave results essentially in agreement with Blanc's law for concentrations, but electron attachment was complete for all samples, independent of concentration. A second measurement technique of high voltage breakdown was used for investigating high voltage breakdown coefficients for the gases, it was determined that 700–800°K represents an approximate threshold for decomposition. Daughter compounds were also electrophilic. Author

N67-13213*# Brigham Young Univ., Provo, Utah. Dept. of Chemistry.
STUDIES OF REACTION GEOMETRY IN OXIDATION OF THE ALKALINE SILVER ELECTRODE Quarterly Report
E. A. Butler and A. V. Blackham 10 Oct. 1966 28 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951554)
(NASA-CR-80528; QR-2) CFSTI: HC $2.00/MF $0.50 CSCL 07D

The measurement and recording of the difference in potential (ΔE) at two points on a working electrode with the simultaneous measurement of the electrode potential was continued. These measurements have supplied data on relating the current distribution in an electrolytic cell to cell and electrode geometry and electrolyte concentration. Simultaneous plots of the ΔE curve, the potential-time curve, and the differential of the potential-time curve are presented. Silver surfaces have been prepared on glass by evaporation deposition, and used as standard electrodes in surface area determinations of various silver surfaces. A standard curve used as a base for surface area determinations has also been obtained. Surface areas of from 2 to 4 cm^2 have been estimated by the technique to within ±5%. Observations indicate the presence of an organic residue on commercial sintered silver electrode part of which is hydrocarbon in character and part of which is carbonaceous. The weight per cent of this residue is 0.01–0.03%. Carbon dioxide is observed as the major product of the pyrolysis in oxygen. Author

N67-13221*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DETERMINATION OF BARIUM IN G-1 AND W-1 BY ISOTOPE DILUTION
C. C. Schnetzler, H. H. Thomas, and John A. Philpotts Jul. 1966 10 p refs
(NASA-TM-X-55583; X-691-66-267) CFSTI: HC $1.00/MF $0.50 CSCL 07B

A mass spectrometric stable isotope dilution technique was used for barium determination in G-1 and W-1 rock standards. The analytical method is detailed, and the results of three separate, independent analyses of G-1, and two of W-1 are tabulated. The actual precision of the isotope dilution method of analysis for barium in the range found in G-1 and W-1 appears to be 1% to 2%; it is suggested therefore that the barium concentration is 1040±20 ppm in G-1, and 158±2 ppm in W-1. However, rare earth analyses indicate that sample inhomogeneity of G-1 may be quite important, and the value of 1040 ppm Ba for G-1 might represent only the concentration in the sample analyzed. M.G.J.

N67-13226*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREPARATION OF ELECTRON PROBE MICROANALYZER STANDARDS USING A RAPID QUENCH METHOD
J. I. Goldstein, F. J. Majeske, and H. Yakowitz (Natl. Bur. of Std.) (Aug. 1966 36 p refs
(NAS-TM-X-55598; X-641-66-361) CFSTI: HC $2.00/MF $0.50 CSCL 07B

A modified Duwez method of splat cooling, in which a small quantity of molten alloy is accelerated and made to strike a cold substrate having a high thermal conductivity, was investigated as a means for preparing several cubic centimeters of standard materials suitable for quantitative electron probe microanalysis. The major requirements for such standards are that the material be homogeneous at micron levels of spatial resolution and that its composition be known. As examples, the Au–Si and Al–Mg binary alloy systems were prepared and characterized by means of electron probe microanalysis, X-ray diffraction, electron microscopy and analytical chemistry. It was concluded that these alloys satisfy all the requirements for a suitable microprobe standard. The relatively simple and inexpensive splat cooling device employed is described in detail. A suggested analysis procedure when using splat cooled standards is also outlined. The electron probe microanalyzer results for the Au–Si and Al–Mg systems are evuated. Author

N67-13230# Commissaria a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
POLAROGRAPHIC STUDY OF Cd(II), Pb(II), Hg(I) IN ANHYDROUS ACETIC ACID [ETUDE POLAROGRAPHIQUE DE Cd(II), Pb(II), Hg(I) DANS L'ACIDE ACETIQUE ANHYDRE]
Marie-Claire Conesa-Botta Jan. 1966 50 p refs In FRENCH
(CEA-R-2903; PB-169349) CFSTI: HC $4.00/MF $0.50

Theory is reviewed of the action of cadmium and lead acetate in anhydrous acetic acid. Experimental results are detailed for the reduction of cadmium perchlorate in perchloric acid, and for the reduction of cadmium acetate in sodium acetate. The polarographic study of lead includes details on the reduction of lead perchlorate in perchloric acid, and the reduction of lead acetate in sodium acetate. Analytical data are also presented on the action of mercury halogens in anhydrous acetic acid. Transl. by R.Ll.

N67-13249# TRW Systems, Redondo Beach, Calif.
STUDY OF THE CHEMICAL INTEGRITY OF RADIOISOTOPE CONTAINMENT MATERIALS IN LAUNCH ABORT ENVIRONMENTS Summary Technical Report, Phase II
J. L. Blumenthal, J. D. Kuenzly, and M. J. Santy Albuquerque, N. Mex., Sandia Corp., Apr. 1966 240 p refs Prepared for Sandia Corp.
(Contract AT(19-1)-789)
(SC-CR-66-2044) CFSTI: HC $6.00/MF $1.25

The materials investigated include cobalt-based superalloys, nickel-based superalloys, stainless steels, and coated and uncoated refractory metals. Author (NSA)

N67-13256# California Univ., Livermore. Lawrence Radiation Lab.
ANALYTICAL CHEMISTRY SECTION Progress Report, 1 Jun–31 Dec. 1966
J. E. Harrar, comp. 31 Dec. 1966 35 p refs
(Contract W-7405-ENG-48)
(UCRL-14767) CFSTI: HC $2.00/MF $0.50

Developments in studies on vacuum analysis equipment and methods, instruments analysis, and solution analysis are reported. Besides various equipment and methods that are described, determination is given for: sulfur in organic compounds; trace impurities in ultrapure gases; yttrium and lanthanides in rock; carbon in high purity titanium; tin in catalyst; and iron and copper in copper ore leach solution. NSA

N67-13262# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF THE OXIDATION RISKS DURING THE SINTERING OF URANIUM DIOXIDE, AND CHARACTERIZATION OF THE EXCESS OXYGEN [ETUDE DU RISQUE D'OXYDATION LORS DU FRITTAGE DU BIOXYDE D'URANIUM ET CARACTERISATION DE L'OXYGENE EXCEDENTAIRE]
May 1966 38 p refs In FRENCH
(CEA-R-3003)

During sintering in reducing atmospheres, UO_2 pellets can be oxidized by gaseous impurities. The effects of temperature cycles, the partial pressure of O_2 and the flow rate of the gas over the pellets were investigated. In these atmospheres, the O_2 partial pressure during sintering is low at high temperatures, as a consequence of the dissociation rate of the combined water, but below 1000°C, it can be high enough to result in a noticeable oxidation of the surface of the pellets during cooling. The crystalline phases which can occur have been identified and two methods of detection have been proposed; a micrographic examination after chemical etching and radiocrystallography. Author (NSA)

N67-13267# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
H/D ISOTOPE EFFECTS IN THE FORMATION OF HYDROGEN FROM THE COMBINATION OF TWO RADICALS IN AQUEOUS SOLUTIONS
M. Anbar and D. Meyerstein Mar. 1966 21 p refs
(IA-1074)

The H/D isotope effects of the reactions $e_{aq}^- + e_{aq}^-$(a), $e_{aq}^- + H$(b), and H+H (c) were determined using high intensity pulse radiolysis. In 1:1 mixtures of $H_2O:D_2O$ at room temperature the following H/D isotope effects were observed: $\alpha_a = 4.7 \pm 0.2$, $\alpha_b = 1.5 - 1.9 \pm 0.3$ (depending on the pH), and $\alpha_c = 2.6 - 3.5 \pm 0.2$ (depending on the pH). The isotope effect of the molecular hydrogen formed in the radiolysis of water, $\alpha_M = 2.2 \pm 0.1$, was found to be independent of pH. In view of the isotope effects, reaction (a) was interpreted in terms of the formation of a $(e_{aq}^-)_2$ center as an intermediate, and reaction (b) as involving the formation of a hydride ion. The results indicate that the molecular and residual hydrogen produced in neutral radiolyzed aqueous solution are formed via reactions different from those assumed in the diffusion model for the radiolysis of water. Most probably these species are formed from excited water molecules. Author (NSA)

N67-13273# Pennsylvania Univ., University Park. Electrochemistry Lab.
INVESTIGATION OF PROPERTIES AND STRUCTURE OF MOLTEN SALTS Annual Progress Report, 1965–1966
John O'M. Bockris 14 Jun. 1966 83 p refs
(Contract AT(30-1)-1769)
(NYO-1769-68) CFSTI: HC $3.00/MF $0.75

Viscosity, Raman spectroscopy, and diffusion in molten salts were studied. The first viscometer capable of use at high pressure and high temperatures was developed. Measurements were made on constant-volume diffusion of ^{134}Cs ions in cesium nitrate. The data obtained confirm and extend the findings that the formation of holes constitutes the rate-determining step in the diffusion process at constant pressure. Further, as the size of the diffusing ion increases, compared with the hole volume in the diffusion medium, a corresponding increase occurs in both the activation energy at constant volume and in the activation volume for jumping. These results can be interpreted very satisfactorily in terms of the Density Fluctuation Hole Model for liquids. The use of laser-excited Raman spectroscopy was extended to fused salts (where its special characteristics offer considerable advantages). Determinations were made in the system sodium nitrate and stannous chloride. The laser Raman apparatus was developed to a point at which any limitations are those set by the salt sample itself rather than by the equipment. In general terms, an increase of some 30 times in sensitivity was achieved together with a great increase in quality of the picture. NSA

N67-13277# Battelle Inst., Frankfurt am Main (West Germany). Isotope and Nuclear Technical Div.
LITERATURE SEARCH ON THE DEPOSITION OF LAYERS OF MOLYBDENUM, TUNGSTEN, AND RHENIUM BY THERMAL DECOMPOSITION OF THEIR CARBONYLS OR REDUCTION OF THEIR GASEOUS HALIDES [LITERATURBERICHT UEBER DIE HERSTELLUNG VON SCHICHTEN AUS MOLYBDAEN, WOLFRAM UND RHENIUM DURCH THERMISCHE ZERSETZUNG IHRER CARBONYLE ODER DURCH REDUKTION VON FLUECHTIGEN HALOGENIDEN]
M. Kadner Apr. 1966 22 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-66-09)

Pure coatings of Mo, W, or Re can be deposited from the vapors of fluorides (W, Re) or chlorides (Mo, W, Re) by reduction with H_2. Details, conditions, and results are discussed. Author (NSA)

N67-13292# MSA Research Corp., Evans City, Pa.
DEVELOPMENT OF TECHNIQUES FOR MEASUREMENT OF IMPURITIES IN SODIUM Quarterly Progress Report, Apr.–Jun. 1966
R. C. Andrews, K. R. Barker, and R. C. Werner Jul. 1966 31 p refs
(Contract AT(11-1)-765)
(MSAR-66-150) CFSTI: HC $2.00/MF $0.50

Surface tension measurements of pure sodium as well as sodium contaminated with 43 ppm oxygen at 300° to 1400°F, were completed. Reaction of sodium-sodium oxide systems with naphthalene in tetrahydrofuran, with subsequent titration of the oxide, gave high values. Measurements are being completed on the 304 SS and 316 SS tabs exposed up to 5500 hr in sodium contaminated with carbon and oxygen. Sampling for sodium oxide determination by electric potential concentration is discussed. Hydrogen measurements using a "diffusion tube" proved successful. NSA

N67-13297# Academia R. P. R., Bucharest.
RELATIONS BETWEEN THE KINETICS OF DEVELOPMENT OF EMULSION SENSITIVITY AND ILLUMINATION [RELATIONS ENTRE LA CINETIQUE DE DEVELOPPEMENT LA SENSIBILITE DE L'EMULSION ET L'ECLAIREMENT]
M. Nicolae 1966 13 p refs In ROMANIAN
(IFA-PN-17)

It was established that there exists an exponential relation between the development speed and the redox potential of the developer in the case of ferroxalate developers for emulsions of different sensitivities and different exposures (light, α particles, and electrons). The exponential constant varies with the sensitivity of

the emulsion and the nature of the incident radiation. This can be explained by the influence of the degrees of dispersion of the latent image centers. It was also established that the relation existing between the activity of the developer and the activation energy of the developer depends on the exposure level. For a given redox potential, the activation energy increases as the exposure decreases. Author (NSA)

N67-13308# State Univ. of New York at Buffalo. Dept. of Chemistry.
STUDIES IN SOLUTION AND NUCLEAR CHEMISTRY
Progress Report, 1 Oct. 1965–30 Sep. 1966
Jacob A. Marinsky and George A. Clarke 30 Sep. 1966 117 p refs
(Contract AT(30-1)-2269)
(NYO-2269-9) CFSTI: HC$4.00/MF$0.75

Research to elucidate ion-exchange phenomenon and to study the solution chemistry of the alkali metals, the alkaline earths, the transition elements, and the rare earths is reported. Various ion-forms of polystyrene sulfonate, the polyelectrolyte analog of commercially produced ion-exchange resins, Dowex-50 and Amberlite IR-120, and polymethacrylic acid, and analog of the commercially produced ion-exchange resin, Amberlite IRC-50, were employed. Ion-exchange as well as polarographic and potentiometric techniques were employed to study solution chemistry. In continuing the study of heavy atom effects on the energy transfer processes in analogs of well-characterized rare earth chelates emphasis was shifted from the β-diketone ligands investigated earlier to uncharged heterocyclic ligands. These latter systems employ nitrogen rather than oxygen bonding. The nuclear portion of the program was enhanced by reactor pulse operation. Author (NSA)

N67-13309# Arizona State Univ., Tempe.
THE SOLID-STATE CHEMISTRY OF RARE EARTH OXIDES
Technical Progress Report
Paul Caro, Le Roy Eyring, J. Kordis, D. Arthur Burnham, James O. Sawyer et al 1 Jul. 1966 355 p refs
(Contract AT(11-1)-1109)
(COO-1109-22) CFSTI: HC$7.15/MF$2.00

Research progress is reported in 8 sections. A separate abstract was prepared for each section. NSA

N67-13316# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
TEXTURE STUDY OF DEVIDED SOLIDS BY GAS ADSORPTION. APPLICATION TO BERYLLIA, ALUMINA AND TO GELS AND OXIDES [CONTRIBUTION A L'ETUDE, PAR ADSORPTION GAZEUSE, DE LA TEXTURE DES SOLIDES DIVISES. APPLICATION A L'ALUMINE, A LA GLUCINE ET A DIFFERENTS GELS ET OXYDES]
Francoise Rouquerol (Ph.D Thesis–Paris Univ.) [1966] 91 p
(CEA-R-2947)

Surface areas of porous materials were measured in an adsorption apparatus with an accuracy of 1/1000. It appears convenient to substitute Ar for N_2. Calculation methods of the pore size distribution are analyzed and discussed. The experimental data shows that the thickness of the multi-molecular layer must be estimated from the number of layers given by Shull using a layer thickness of 3.6 Å. A new method of analysis of the desorption curve is also given. It is also shown that a certain number of lamellar, nonporous systems, such as $Be(OH)_2$ present a hysteresis branch on the adsorption isotherm of type I or II. It is concluded that this hysteresis can be ascribed to the lack of rigidity of the solid. Samples of microporous texture ($r<20$Å) of the BeO-type are an example of porous materials which do not exhibit a hysteresis phenomenon. The evolution of the texture during their progressive dehydration (thermal treatment from 150 to 1100°C) of samples of BeO and Al_2O_3, is described. Author (NSA)

N67-13317# Battelle Inst., Frankfurt Am Main (West Germany).
THEORETICAL EVALUATIONS OF CHEMICAL REACTIONS OF CARBIDES AND OXIDES SUITABLE FOR THE CONSTRUCTION OF NUCLEAR-FUELED THERMIONIC EMITTERS [THEORETISCHE UNTERSUCHUNGEN UEBER DIE CHEMISCHEN REAKTIONEN KARBIDISCHER UND OXIDISCHER WERKSTOFFE, DIE FUER DIE KATHODEN NUKLEARER, THERMIONISCHER KONVERTER IN BETRACHT KOMMEN]
E. Poeschel and H. Rochow Apr. 1966 20 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-66-07)

Combinations of suitable materials to prepare coated-particle filled emitters for thermionic converters are discussed. In the case of coated particles with a PyC outer layer and UC_x-containing kernels, the connecting matrix may be composed of NbC, TaC, or ZrC if Re is used as electron-emitting material. In the case of W emitters, the only suitable matrix material is ZrC. Coated particles with UO_2 kernels and outer layers of Mo or W are advantageously embedded into BeO. This is applicable to both W and Re as emitter material. Author (NSA)

N67-13320# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
VAPORIZATION OF THE ACTINIDES AND THEIR COMPOUNDS. PART I: BASIC PROBLEMS OF VAPORIZATION STUDIES.
I. Krivy May 1966 40 p refs In CZECHOSLOVAK; ENGLISH summary
(UJV-1598)

Individual stages of vaporization studies are discussed, including: establishment of the general behavior of the system, identification of the gaseous species, formulation of the net reaction(s), vapor-pressure measurement, and study of the kinetics and the mechanism of vaporization processes. The general principles of the theory of vaporization and usual treatment of experimental results are also given. Earlier studies in the field of vaporization of actinide elements (Th, U, Np, Pu, Am, and Cm) are reviewed. The best approximations for temperature dependence of the pressure of monoatomic vapor, the standar free energy, enthalpy, and entropy of vaporization (sublimation) are presented separately for each actinide metal. In addition estimated values of normal boiling point are included for individual actinides as well as the appropriate values of standard heat and entropy of vaporization at normal boiling point. Partial correlation and comparison of the thermodynamic data characterizing the vaporization of actinides were made with those for lanthanides. Author (NSA)

N67-13321# Louisville Univ., Ky. Dept. of Chemistry.
THERMAL DEGRADATION OF STYRENE AND METHYLMETHACRYLATE COPOLYMERS WITH PURE m-DIVINYLBENZENE AND p-DIVINYLBENZENE ISOMERS
Frank E. Martin (Ph.D. Thesis) 1966 162 p refs
(Contract AT(40-1)-2055)
(TID-23264) CFSTI: HC$5.00/MF$1.00

The high temperature degradation of styrene copolymerized with 8 mole per cent m- or p-divinylbenzene was studied in order to further establish differences in the copolymer networks dependent on the nature of the divinyl units. It is supposed that if polystyrene degrades predominantly by reverse polymerization, i.e., stepwise terminal monomer unit cleavage, then the amount of para-related products in the copolymer pyrolyzates should be negligible at low conversions but should increase rapidly as depolymerization proceeds toward the copolymer nuclei. On the other hand, m-DVB related products should be observed early in the degradations and regularly. Degradation of the isomerically crosslinked copolymers at 552° and 627°C tends to confirm this hypothesis. The results tend to confirm not only the differences postulated in devinylbenzene unit distribution, but also that polystyrene does degrade to an appreciable extent by stepwise terminal monomer unit cleavage. The postulated

differences between m- and p-divinylbenzene distributions in the copolymers of both styrene and methyl methacrylate were additionally confirmed by comparing the rates of formation of individual degradation products, the rates of formation of individual degradation products, the rates of volatilization, and the activation energies for volatilization. Nearly all of the volatile degradation products for the various polymers and copolymers were identified by vapor phase chromatographic analysis. Mechanisms for the formation of many of the secondary products are proposed. NSA

N67-13334# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

COULOMETRIC DETERMINATION OF CARBON IN PLUTONIUM AND IN URANIUM–MOLYBDENUM ALLOYS [DOSAGE DU CARBONE PAR COULOMETRIE DANS LE PLUTONIUM ET LES ALLIAGES URANIUM–MOLYBDENE]

Bernard Pichotin and Philippe Chasseur Jun. 1966 19 p refs In FRENCH
(CEA-R-2968)

A rapid and reliable coulometric method for the determination of carbon is described. Analysis time for the uranium alloy is 10 minutes; for plutonium it is 45 minutes. The limit of sensitivity is about 5 ppM for a sample of 1 g. NSA

N67-13336# Delaware Univ., Newark. Dept. of Chemistry.

PRIMARY CHEMICAL PROCESSES IN THE RADIOLYSIS OF LIQUIDS Annual Progress Report, 15 Sep. 1965–14 Sep. 1966

C. N. Trumbore 11 Jun. 1966 14 p refs
(Contract AT(30-1)-2668)
(NYO-2668-13) CFSTI: HC$1.00/MF$0.50

Studies were continued on the detection in liquids of chemical and physical precursors ultimately responsible for radiolytic damage. Continuing studies on the aqueous *p*-nitrosodimethylaniline (RNO) system provided some results that may not be accounted for by the commonly invoked radiolytic intermediates, H, OH and e_{aq}^-. These studies were carried out at low RNO concentrations where quantitative studies are made of G(—RNO) as a function of RNO concentration, pH, and added solute concentration. Several pieces of evidence point to some kind of excited water molecule such as the H-, OH-, and/or e_{aq}^- precursor, which is scavenged at high solute concentrations. An oxygen concentration effect cannot be explained by the usual competition mechanism invoked in radiation chemistry and an energy transfer mechanism that possibly activates dissolved oxygen is suggested. Pulse radiolysis studies of aqueous solutions were carried out in which the absorption of laser radiation during the pulse of X-rays occurs and is detected with a rise time in the nanosecond region. Studies on the gamma radiolysis of the cyclopentanone–benzene system demonstrated a benzene triplet scavenging action, which is in quantitative agreement with photolysis studies on the same system. A yield of G(benzene triplet) = 0.4 is reported. Author (NSA)

N67-13337# Mellon Inst., Pittsburgh, Pa.

RADIATION RESEARCH Quarterly Report, 1 Apr.–30 Jun. 1966

15 Jul. 1966 12 p refs *Its* Fundamental Res. No. 6041
(Contract AT(30-1)-2310)
(RRL-2310-182) CFSTI: HC$1.00/MF$0.50

Results are reported on the following studies: ESR spectra of some isotopically substituted hydrocarbon radicals and fluorine-containing radicals, PF_4 and SF_4^+; liquid phase argon-sensitized radiolysis of ethylene; effects of hydrogen iodide on hydrogen and radical yields in irradiated hexane; identification of radicals and measurements of their yields by ESR and scavenger methods; and decolorization of blue cellophane films by high LET radiation. Preliminary results are also given for studies on: radiolytic dissociation of methyl iodide in cyclohexane solutions; competition between N_2O and C_2F_4 for electrons in the radiolysis of propylene; spectroscopic studies of alkali hydroxide glasses; effects of added gases in the Hg photosensitized decomposition of cyclobutane, a high intensity lamp for vacuum ultraviolet photochemical studies; and oxygen-18 isotopic dilution studies of oxygen body stores. NSA

N67-13338# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

RADIATION-INDUCED OXIDATION OF METHANOL

A. Habersbergerova, I. Janovsky, and J. Teply May 1966 17 p refs
(UJV-1467)

Radioinduced oxidation of methanol resulted in hydrogen, methane, formaldehyde, ethylene glycol, hydrogen peroxide, hydroxymethylhydroperoxide, formic acid, and carbon dioxide yields. A reaction scheme is proposed to account for dependence of yields of hydroxymethylhydroperoxide, hydrogen peroxide, formaldehyde, and of oxygen consumption on the inverse value of the square root of the gamma dose rate and the independence of hydrogen yield on the dose rate. At high doses due to secondary reactions carbon dioxide is formed and formic acid decomposed. NSA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N67-12301*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TELSTAR I, VOLUME 4

Dec. 1965 448 p refs
(NASA-SP-32, Vol. 4) CFSTI: HC$7.48/MF$2.00 CSCL 17B

Papers on operation, characteristics, and performance of communications satellite tracking facilities are presented. For individual titles see N67-12302–N67-12320.

N67-12302*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FUCINO EARTH STATION OPERATION ANALYSIS

In its Telstar I, Vol. 4 Dec. 1965 p 1941–1947 (See N67-12301 03-07) CFSTI: HC$7.48/MF$2.00

A description and operational analysis of the Fucino communications station is presented. This station is located close to Roma, Italy; it encompasses a 30 ft. steerable dish antenna for monopulse beacon tracking and communications receiving and also video band and test equipment. A wideband reception test via Telstar was successfully conducted at the station. The employed monopulse tracking system yielded good results and proved satisfactory. G.G.

N67-12304*# Centre National d'Etudes des Telecommunications, Issy-les-Molineaux (France).

RESULTS OF TESTS PERFORMED WITH THE TELSTAR SATELLITE AT THE PLEUMEUR–BODOU SATELLITE COMMUNICATION STATION

L. Bourgeat, A. Dyeure, and J. P. Houssin *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 1999–2055 (See N67-12301 03-07) CFSTI: HC$7.48/MF$2.00

Active satellite communications tests at this French ground station were analyzed to establish the feasibility of satellite acquisition and tracking by a very narrow beamwidth antenna. System tests of telephone channels and television links via satellite confirmed the possibility of a wideband communications link between continents by the use of satellites. A solution for the problem of

pointing the directive antenna accurately in the direction of a satellite at the moment it appears and then keeping it pointed at the moving satellite was found. G.G.

N67-12306*# Post Office Engineering Dept., London (England).
THE GOONHILLY 85-ft. STEERABLE DISH AERIAL
C. N. Kington (Husband and Co.) and H. E. Pearson *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2077–2089 Reprinted Prepared in Cooperation with Husband and Co. (See N67-12301 03-07) CFSTI: HC$7.48/MF$2.00

Design, manufacture, construction, and testing of an 85-feet steerable dish aerial for a satellite communication ground station is discussed. A fully transistorized digital control system is used to drive the system automatically from a control desk. Successive tracking observations of the star Alpha Ursa Major produced smooth azimuth and elevation angles against time as the star moved across the sky and thus proved that the aerial pointed correctly. Measurements on incoming radio signal strength from a 4000 Mc/s transmission source about 21 miles distant, established the measured beamwidth at 13 minutes as compared with the theoretical value of 12 minutes. G.G.

N67-12307*# Post Office Engineering Dept., London (England).
COMPUTING AND DATA TRANSMISSION FOR THE PREDICTION STEERING OF THE GOONHILLY SATTELITE-COMMUNICATION AERIAL
E. C. Seaman and W. E. Thompson *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2091–2099 Submitted for Publication (See N67-12301 03-07) CFSTI: HC $7.48/MF$2.00

Orbital prediction computations were converted into continuous real-time azimuth and elevation pointing instructions for a satellite tracking ground station aerial. Satellite position predictions were expressed by a rectangular coordinate system with axes in the directions East, North, and vertical and the origin at the center of the aerial's motion. Predictions in this form were transmitted over transoceanic telegraph circuit for a receiving teleprinter that produced simultaneously a page print and a perforated tape. Transmission time was about six seconds for each minute of satellite pass. G.G.

N67-12308*# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
DIGITAL TECHNIQUES USED IN THE STEERING APPARATUS OF THE GPO STEERABLE AERIAL AT GOONHILLY DOWNS
J. E. Marshall, R. J. Coulter, J. K. Binks, K. J. Clarke, T. Stevenage et al *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2101–2116 Reprinted (See N67-12301 03-07) CFSTI: HC$7.48/MF$2.00

A description of the logic design for the digital control equipment is followed by further descriptions of items of particular interest. The means of applying off-sets to the demanded aerial position for overcoming possible inaccuracy of the predicted orbit; and to demand accurately determined velocities manually; means of cooperation from pure binary form to provide displays in terms of angles, and the derivation of analogue voltages for the servo-amplifiers are discussed in detail. A critical analysis of the equipment in the light of operational experience concludes the paper. Author

N67-12310*# Post Office Engineering Dept., London (England).
A 4/6 Gc/s CIRCULARLY-POLARIZED DIPLEXER FOR THE GOONHILLY SATELLITE-COMMUNICATION AERIAL
D. Chakraborty and G. F. D. Millward Submitted for Publication (See N67-12301 03-07)

A diplexer is described that transmits some 4 to 5 kilowatts of microwave power and simultaneously receives a micro-microwatt signal from a communications satellite when used in conjunction with an earth station aerial. The diplexer works together with a broadband reciprocal polarizer since the transmitted signal in the dish aerial polarizes left handed and the received signal emits polarized righthanded. This diplexer and broadband polarizer system were successfullly used for tests with Telstar satellite transmissions. G.G.

N67-12311*# Post Office Engineering Dept., London (England).
PRIMARY FEEDS FOR THE GOONHILLY SATELLITE-COMMUNICATION AERIAL
I. A. Ravenscroft *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2141–2155 refs Submitted for Publication (See N67-12301 03-07) CFSTI: HC$7.48/MF$2.00

The 85-ft. diameter aerial described uses a focal-plane paraboloidal reflector illuminated from a primary feed at the focus to transmit and receive circularly polarized waves. Circular symmetry of the primary feed radiation patterns is achieved by: (1) the ratio of the actual gain obtained to that of a uniformly illuminated aperture of the same area; (2) the ratio of the energy illuminating the reflector to the total energy radiated by the feed; (3) the energy radiated by the feed, not illuminating the reflector; and (4) the ratio of aerial gain to the total receiving system noise-temperature in degrees Kelvin. Experiments with circular flangs about a circular waveguide aperture gave primary feed patterns gain factors of about 0.65 and an effective noise temperature increase of about 2.5°K due to spillover. G.G.

N67-12312*# Post Office Engineering Dept., London (England).
WAVEGUIDE FEEDER SYSTEM FOR THE GOONHILLY SATELLITE-COMMUNICATION EARTH STATION
I. F. Mac Diarmid and S. C. Gordon *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2157–2166 Submitted for Publication (See N67-12301 03-07) CFSTI: HC $7.48/MF$2.00

Special features of the waveguide installation on the aerial are outlined and performance data are given. Three separate waveguide connections between the turntable cabin and the focus platform are required to rotate the joints on the elevation axis of the aerial; one each for the Telstar and Relay transmitters operating at 6390 and 1725 Mc/s, respectively, and one for the receiver feed routed via mezer cabin on the back of the dish antenna and operating at 4170 and 4080 Mc/s. A dominant-mode rectangular waveguide is used for these runs. G.G.

N67-12316*# Post Office Engineering Dept., London (England).
DEMODULATION TECHNIQUES FOR USE AT GOONHILLY SATELLITE-COMMUNICATION EARTH STATION
R. W. White and R. J. Westcott *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2201–2210 refs Submitted for Publication (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

The following three types of demodulators were evaluated to determine optimum demodulation techniques for communication satellite systems: (1) a conventional demodulator; (2) a frequency modulation feedback demodulator in which the signal deviation is reduced before it reaches the final discriminator; and (3) a variable bandwidth dynamic-tracking demodulator in which the resonant frequency of a narrow bandwidth tuned circuit moves rapidly to follow the nominal instantaneous frequency of the incoming signal. It was concluded that for a carrier/noise ratio greater than that corresponding to threshold conditions, a conventional demodulator is preferred; specialized demodulators can be efficient at carrier/noise ratios less than 10 db; and at carrier/noise ratios less than 6 db show a marked preference for specialized demodulators. G.G.

N67-12317*# Services Electronics Research Lab., Baldock (England).
A HIGH POWER TRAVELLING WAVE TUBE FOR SATELLITE COMMUNICATIONS

M. O. Bryant, A. Thomas, and P. W. Wells *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2211–2217 refs Submitted for Publication (See N67-12301 303-07) CFSTI: HC $7.48/MF $2.00

This paper describes the CW travelling wave tube used by the General Post Office in their ground transmitter for Project Telstar. It operates in the 6000 Mc/s band with a maximum power output of about 5 kw and a bandwidth of greater than 100 Mc/s. The factors influencing the design of the valve and its performance are discussed in some detail. Author

N67-12318*# Associated Electrical Industries, Ltd., Manchester (England).

THE OUTPUT STAGE FOR THE GROUND TRANSMITTER AT GOONHILLY

A. R. Fatherham *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2219–2227 ref Submitted for Publication (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

A traveling wave tube with a bandwidth of about 100 Mc/s is used as power output amplifier for a ground transmitter. The electron beam in the tube passes first through a hole in the anode and then through the center of a cloverleaf slow wave structure before striking the collector. Amplification takes place due to the interaction between the beam and the fields associated with the waveguide structure. This amplifier is located in a cabin placed on a turntable underneath the ground station's aerial. G.G.

N67-12319*# Post Office Engineering Dept., London (England).

RESULTS OF TESTS AT GOONHILLY USING THE EXPERIMENTAL COMMUNICATION SATELLITES TELSTAR I AND TELSTAR II

W. J. Bray, F. J. D. Taylor, and R. W. White *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2229–2260 (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

Results from tests and demonstrations with the Telstar satellites were surveyed and examined. Evaluation of television transmission, multiple channel telephony and telegraphy, and facsimile and data transmission showed that active communication satellites can provide high quality stable circuits; especially good transmissions were obtained for color television signals. The tracking of satellites to within 10 minutes of arc, from orbital data predicted up to a fortnight in advance, is established. G.G.

N67-12320*# Bell Telephone Labs., Inc., New York.

COMMUNICATIONS AND RADIATION EXPERIMENTS WITH TELSTAR II

In NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2263–2373 refs (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

Test results made on Telstar II shortly after launch in May, 1963, and again during March and April, 1964, did not establish any unpredicted performance changes during the eleven months. Comparison of radiation damage between Telstar I and Telstar II found deterioriation of the small solar power plant and the measuring sensor transistors in Telstar II due to the presence of very large fluxes of low energy protons. Electron measurements made in a higher energy range on Telstar II showed the characteristics of the inner and outer Van Allen belt structure. G.G.

N67-12388# Simmonds Precision Products, Inc., Tarrytown, N. Y.

AN/PRC-65 RADIO SET Interim Technical Report

Edward M. Ulicki Griffiss AFB, N. Y., RADC, Mar. 1966 99 p (Contract AF 30(602)-3445)

(PD-5536; RADC-TR-65-211; AD-631084) CFSTI: HC $9.60/MF $0.75

The task was to design and develop an ultra-miniature, high-reliability radio set, having over 1000 channels operating in the VHF frequency range of 100 to 156mc. This radio set is to operate from a single crystal source, transmit in the given frequency range in 50kc steps, and have the capability of changing frequencies by means of a single digital switch. The radio set uses many new innovations and techniques, some of which are: a broadband transceiver which is untuned except for a bandpass filter; a digital frequency synthesizer to obtain the large number of channels from a single frequency source; and integrated and thin-film circuits for obtaining high packaging volume and high reliability. Extensive development work was expended on designing the broadband RF power amplifier and its associated modulator. These circuits have proven to be very successful and can be adapted for extension in the UHF frequency range of 225 to 400 mc. Author (TAB)

N67-12411# Joint Publications Research Service, Washington, D. C.

PROBABLE ESTIMATION OF DUOBINARY CODE WITH DETECTION AND CORRECTION OF ERRORS

B. Ys. Sovetov *In its* Izv. VUZon: Instr. Bldg. 2 Oct. 1966 p 44–48 refs (See N67-12401 03-14) CFSTI: $4.00

An examination is presented of the design principle of a duobinary code and of the detection and correction of errors. Their stochastic indexes are included. Author

N67-12413# Joint Publications Research Service, Washington, D. C.

CHARACTERISTICS OF METHODS OF SYNCHRONIZING INFORMATION TRANSFER BY MULTIFREQUENCY CODES

V. I. Vasil'yev, I. Galek, and I. Shtefka N67-12401 03-14) CFSTI: $4.00

Consideration is given to methods of synchronizing information transfer by multifrequency codes with correction of errors. Expressions are given for determining the significance of codes, and the structural forms of devices for the development of sequential and parallel codes are presented. Author

N67-12477# Radio and Space Research Station, Slough (England).

KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR APRIL 1966

1966 40 p *Its* Issue No. 16

CFSTI: HC $2.00/MF $0.50

Satellite orbital observations received by the Satellite Orbits Group from Malta for April, 1966 are reported. Data contain time, azimuth, elevation, accuracy, and magnitude. G.G.

N67-12478# Radio and Space Research Station, Slough (England).

KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR MAY 1966

1966 38 p *Its* Issue No. 17

CFSTI: HC $2.00/MF $0.50

Kinetheodolite satellite observation data are reported by the Satellite Orbits Group from Malta for May, 1966. Considered are time, azimuth, elevation, accuracy, and magnitude. G.G.

N67-12518# Joint Publications Research Service, Washington, D. C.

INFORMATION PROCESSING. OPTIMAL DETECTION OF MARKOV SIGNALS AGAINST A BACKGROUND OF MARKOV NOISE WITH DISCRETE TIME

Yu. G. Sosulin *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 185–197 refs (See N67-12501 03-10) CFSTI: $6.00

A method is discussed for solution of problems of optimal detection of Markov signals against a background of nonadditive Markov noise. The signal and noise are Markov (in the general

case nongaussian) processes which take place in discrete time. The recurrent expressions are obtained with the help of which it is possible to synthesize and also analyze optimal receivers. The general recurrent expressions are given for specific examples. Author

N67-12519# Joint Publications Research Service, Washington, D. C.
A BASIS FOR PROGNOSIS USING TRANSIENT STATISTICS
I. V. Terent'yev *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 198–213 refs (See N67-12501 03-10) CFSTI: $6.00

A theoretical basis is given for prognosis using transient statistics for random processes represented as a mean square in the form of Taylor series (in the region of existence). The applications of the prognosis to certain problems in cybernetics are discussed. Author

N67-12522# Joint Publications Research Service, Washington, D. C.
THE INFLUENCE OF THE ERROR IN REALIZATION OF AN OPTIMAL DISTRIBUTION FILTER ON THE ERROR IN REPRODUCTION OF INFORMATION
V. L. Volkovich *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 231–240 refs (See N67-12501 03-10) CFSTI: $6.00

Integral equations are derived for the weight function of an optimal filter and the error in reproduction of information for distributed reception, taking into account the absolute and relative error in realization of the filter. It is concluded that (1) the correlation function of the random absolute error does not influence the expression for the optimal weight function, but affects the relative square error in reproduction of the information; and (2) the correlation function of the random relative error enters into the expression for the optimal weight function, and the relative square error depends on the random error via the optimal weight function. K.W.

N67-12539# National Research Council of Canada, Ottawa (Ontario). Div. of Radio and Electrical Engineering.
BULLETIN OF RADIO AND ELECTRICAL ENGINEERING DIVISION
Repr. from Bull. Radio and Elec. Eng. Div. (Ottawa), v. 15, no. 4, Dec. 1965 55 p refs

Contents: Laboratory study of corona at subfreezing temperatures, by M. M. Khalfa, R. M. Morris; Self-balancing A-C current comparator, by O. Petersons; Assembly of multi-element interferometer, by T. H. Legg, M. F. Bell; Control system for 150-foot radio telescope, by W. A. Cumming; Atmospheric attenuation at 3 Gc/s, by W. J. Medd; Micrometeoroid detector with an acoustically isolated sensing surface, by R. Wlochowicz; Punched paper-tape system for rocket telemetry data, by M. Ito; Large Aluminosilicate ultrahigh-vacuum system, by J. P. Hobson, J. W. Earnshaw; Monopole mass spectrometer; Surface physics; Quantum electronics; Aids to navigation (tacan antennas and photoelectric tracking of model ships); Radar for study of hailstorms. TAB

N67-12640# Sylvania Electric Products, Inc., Waltham, Mass. Applied Research Lab.
WULLENWEBER ARRAYS
Rolf M. Wundt [1966] 53 p Presented at the 12th Symp. of the AGARD Avionics Panel on Radio Antennas for Aircraft and Aerospace Vehicles and Signal Processing Arrays

Two configurations of Wullenweber Arrays with extended frequency range are examined and their essential parts described. These antennas provide a multiplicity of fixed high gain beams, and low gain sector beams convering 360° in azimuth and giving broad elevation coverage. Using a suitable beam forming system, multicouplers, and an elaborate RF distribution system, a receiving system requiring a relatively small area and providing multiple access for a large number of receivers is obtained. Precise signal direction of arrival with accuracies of better than one degree have been obtained with a low insertion loss goniometer, and the phase interferometer technique. System performance was improved in high gain low noise solid state amplifiers, low insertion loss power dividers and combiners, highly stable delay lines with very tight amplitude and phase tracking, and broadband multicouplers. Overall system and design considerations as well as performance characteristics of a typical system are presented. Author

N67-12771# Joint Publications Research Service, Washington, D. C.
SYNTHESIS OF TELEMECHANICAL CODERS BASED ON CODE-INTERSECTION DIAGRAMS
F. E. Keller *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 43–46 refs (See N67-12761 03-14) CFSTI: $5.00

The decoding properties of code-intersection diagrams are reviewed, and the possibilities for coding offered by such diagrams are considered. A method is suggested for the synthesis of coders of telemechanical systems. Author

N67-12809*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
POWER AND CROSS-POWER SPECTRUM ANALYSIS BY HYBRID COMPUTERS
Raymond S. Kim and William D. Cameron Washington, NASA, Dec. 1966 28 p refs
(NASA-TM-X-1324) CFSTI: HC $2.00/MF $0.50 CSCL 09D

A method for analyzing power and cross-power spectra from 0.1 Hz to 20 kHz with general purpose hybrid computers is described. The method is valid for analyzing continuous and discrete spectra of periodic, aperiodic, complex, and stationary random signals. A spectrum is analyzed entirely on the analog computer by a pseudo band-pass filter method. The bandwidth and the averaging time are varied to suit the computation requirement of each spectrum. The digital computer is used for automatic control of the analog computer, for data acquisition, and for compensation of magnetic tape static skew. The definition of power and cross-power spectra, and the validity of various methods of analysis are comprehensively reviewed. Author

N67-12837# Academy of Sciences (USSR), Moscow. Astronomical Committee.
RESULTS OF OBSERVATIONS OF SOVIET ARTIFICIAL EARTH SATELLITES, NO. 69
1964 47 p
CFSTI: HC $2.00/MF $0.50

Equatorial and horizontal coordinates are given for March 1963 for the following satellites: Sputnik 1960 Epsilon; Cosmos II, V, and VIII; and Cosmos XI and XIII including rockets. Transl. by K.W.

N67-12848# Indian Inst. of Science, Bangalore. Dept. of Electrical Communication Engineering.
SURFACE WAVE PROPAGATION THROUGH ANISOTROPIC CIRCULAR, CYLINDRICAL DIELECTRIC ROD WAVEGUIDE
D. K. Paul *In its* J. of the Indian Inst. of Sci., Vol. 48, No. 2 and 3 Jul. 1966 p 102–125 refs (See N67-12843 03-34) CFSTI: HC $3.00/MF $0.75

The expressions for the propagation characteristics, such as, the radial propagation constants, the axial propagation constant, the guided wavelength, and the cut-off conditions for a circular, cylindrical, anisotropic dielectric rod waveguide excited by the symmetric electric and symmetric magnetic modes have been derived. Numerical calculation of these characteristics as a function of the diameter and the dielectric constant of the guide have been completed and the results are presented graphically. The electric and the magnetic field distributions inside and outside the waveguide as a function of a diameter are also given. Author

N67-12933*# Alabama Univ. Research Inst., Huntsville. Bureau of Engineering Research.
LOCATION OF PATTERN-DISTURBING STRUCTURES IN THE VICINITY OF AN ANTENNA Final Report, Jun. 5, 1963–Sep. 15, 1966
Harold Mott, Joseph C. Dowdle, and James E. Dudgeon 15 Sep. 1966 103 p refs
(Contract NAS8-5412)
(NASA-CR-79729) CFSTI: HC $4.00/MF $0.75 CSCL 20N

The problem of finding a current or voltage distribution in the vicinity of a vehicle antenna from a knowledge of the system radiation pattern is investigated. The object of determining the source distribution is to locate structural features near the antenna having significant effect on the radiation pattern. It was assumed that structural features that have high current densities will affect the radiation pattern significantly. Several synthesis methods for finding the source distribution from the radiation pattern were discussed. Source geometries considered were linear, circular, rectangular planar, and cylindrical. The methods used ranged from the simple Fourier series study of straight-line sources to such a highly complex method as the Gram–Schmidt orthogonalization procedure. The linear Fourier series method was applied to measured radiation patterns of a slot on a finite ground plane with obstacles placed on the plane. S.P.

N67-12948# Environmental Science Services Administration, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.
ZONAL HARMONICS IN LOW FREQUENCY TERRESTRIAL RADIO WAVE PROPAGATION
J. Ralph Johler 13 Apr. 1966 26 p refs
(NBS-TN-335) GPO: $0.25

The zonal harmonic series can be employed to calculate each term of a geometric series by interchanging the order of summation of two series. This method of analysis provides a practical solution to the propagated low frequency terrestrial waveguide field. Thus, the geometric series terms (often called wavehops) can be calculated quickly and accurately with the zonal harmonic series. The summation of the geometric series then provides an efficient method for calculating the total field (or waveguide mode sum). Computation speed is obtained on the large scale computer by use of recursion formulas for the Legendre and spherical wave functions. When compared with the complex integral method, this simple analysis offers an advantage as an alternative approach to the propagation problem. S.P.

N67-12949# National Environmental Satellite Center, Suitland, Md.
TOS DATA HANDLING PLAN
B. Zavos Feb. 1966 88 p

A data handling plan is presented showing the basic concepts and guidelines that will be followed in the acquisition, processing, and delivery to the users of TIROS Operational Satellite system data. The plan enumerates the several output products which the system can produce and shows the constraints imposed on these outputs by system components. The flow of data through the system during normal operations is indicated. In addition, plans for operating under specific abnormal conditions are presented. Author

N67-12953# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
VOR LOCALIZER (VORLOC) Interim Report
Frederick W. Marschall Oct. 1966 22 p ref
(RD-66-52)

A low cost system called VORLOC is described. This equipment was designed to be used in a manner similar to a standard localizer but operates on VOR frequencies with the standard VOR receiver and instrumentation. The results of tests indicate that the quality of the course line of VORLOC is subject to its siting. The course line had an average 95% course path bend amplitude of .51 degrees, with extremes of .99 and .25 degrees. The maximum range was 31 miles at 2000 feet altitude and the stability of the course line was .57 degrees per standard deviation. It is concluded that VORLOC has potential as a low cost navigational aid capable of providing localizer-type guidance through a standard VOR receiver. Author

N67-12976*# Allied Research Associates, Inc., Concord, Mass. Aracon Geophysics Div.
THE NIMBUS II DATA CODE EXPERIMENT
Leon Goldshlak and William K. Widger, Jr. Jan. 1966 82 p refs
(Contracts NAS5-10114; NAS5-3253)
(NASA-CR-80162; TN-1; Rept.-8G28-2) CFSTI: HC $3.00/MF $0.75 CSCL 09F

The Nimbus II Data Code is an integral part of the Automatic Picture Transmission (APT) system. It provides information as to the positions and times of both the ascending nodes and the perigees of Nimbus orbits, as well as the exact time of each APT picture on which it appears. The information provided by Data Code is used to update ephemeris, which is mailed or transmitted over conventional weather or other communications at relatively infrequent intervals. These combined sources of data are designed to be used with standard APT plotting boards and geographical grids to provide all orbital information needed to acquire and geographically locate both APT and Direct Readout Infrared Radiometer (DRIR) data. Detailed procedures for the interpretation of the Data Code, and its use for acquiring and locating the data, are provided. Author

N67-12978*# Purdue Univ., Lafayette, Ind. Electronic Systems Research Lab.
TAPPED DELAY LINE SIMULATION OF RANDOMLY TIME-VARIANT CHANNELS
C. C. Bailey Sep. 1966 50 p refs
(Grant NsG-553)
(NASA-CR-80358; Memo.-66-2) CFSTI: HC $2.00/MF $0.50 CSCL 09D

Definitions of the appropriate functions needed to specify randomly time-variant systems are given, and the tapped delay line method of simulation for the time-variant channels is derived. Attention is given to determining how closely the delay line system approximates the mathematical model. The linear delay and linear amplitude distortion parameters associated with a channel are defined and discussed, and the equations necessary to compute them on the digital computer are derived. The outlined theory is then used with a theoretical model of a tropospheric scatter channel to design a digital computer simulator for troposcatter channels. Experimental results obtained with this simulator are included. K.W.

N67-12984*# Ohio State Univ. Research Foundation, Columbus. Dept. of Electrical Engineering.
THE REFLECTION COEFFICIENT OF A TEM MODE PARALLEL-PLATE WAVEGUIDE ILLUMINATING A PERFECTLY REFLECTING SHEET
Leonard L. Tsai (M.S. Thesis) 25 Aug. 1966 88 p refs
(Grant NGR-36-008-048)
(NASA-CR-80351; Rept.-2143-1) CFSTI: HC $3.00/MF $0.75 CSCL 20N

The reflection coefficient of a parallel-plate waveguide operating in the TEM mode and illuminating a perfectly conducting sheet is analyzed as a function of guide aperture to reflector distance by using wedge diffraction techniques. For the half-plane guide, the reflection coefficient is easily obtained by integrating the reflected field over the guide aperture. For guides with finite wedge angles less than 90°, the reflection coefficient is found by assuming that

the interactions between the guide aperture and reflecting sheet are bouncing plane waves and obtaining them through the higher-order diffraction concept. For ground plane mounted guides, the reflection coefficient is obtained through an iterative process of successively bouncing cylindrical waves. Author

N67-13020*# Environmental Science Services Administration, Boulder, Colo.
IDEALIZED ANTENNA PATTERNS FOR USE IN COMMUNICATION-SATELLITE INTERFERENCE STUDIES
P. L. Rice, W. I. Thompson, III, and J. L. Noble [1966] 14 p refs
(NASA Order R-68)
(NASA-CR-79405) CFSTI: HC $1.00/MF $0.50 CSCL 17B

Antenna patterns to represent earth station antennas of communication satellite systems are derived from available published data. The patterns include an analytic expression describing the main beam and first side lobe. Higher order side lobes are specified in terms of smoothed mean power levels of these side lobes. Author

N67-13029*# Autonetics, Anaheim, Calif.
STUDY FOR A FLIGHT FAILURE WARNING AND ANALYSIS PCM SYSTEM Final Report
15 Nov. 1965 72 p
(NASA-CR-80421; TS-2110/319) CFSTI: HC $2.50/MF $0.75 CSCL 09F

The AWARE system fulfills all expected flight failure warning requirements. This automatic airborne combination of digital computer and pulse code modulator monitors up to 256 parameters and compares them to normal operating limits; it displays a failure warning signal on the pilot's panel and injects an audio pulse into his headset if any parameter exceeds the normal operating range. The pilot can call up any measurement for display in alpha numeric terms and in engineering units. G.G.

N67-13033# Texas Univ., Austin. Antennas and Propagation Div.
A BISTATIC RADAR EXPERIMENT Preliminary Report
J. J. Stephens 15 Jun. 1966 123 p refs
(Contract DA-49-092-ARO-87)
(P-8; AD-638673) CFSTI: HC $4.00/MF $0.75

The large-angle, Mie scattering characteristics of precipitation volumes are presented for a model drop-size distribution. Tentative signal analysis procedures for a bistatic radar experiment are discussed. Author (TAB)

N67-13078# Electric and Musical Industries, Ltd., Hayes (England).
APPLICATION OF AN IMAGE INTENSIFIER TO RADAR SPECTRUM ANALYSIS
Roger Voles *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 313–327 (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

In certain types of coherent radar it is required to derive the Doppler spectrum of the returns while preserving range resolution. It is proposed that this function may be performed by the use of an image intensifier. In this arrangement, the returns are painted as brightness modulation along the vertical diameter of a CRT having a phosphor decay time in the order of the interval between pulses. This line is projected onto the vegetation of an image intensifier in which a horizontal deflection circuit is used to sweep the resultant image across the output phosphor which has a relatively long decay time. Alternatively, the light output from a phosphor with a short decay time may be projected onto the signal plate of a camera. During the sweep the gain of the intensifier is varied sinusoidally at a rate dependent on the position of the pulse in the group under analysis. It is shown that the birghtness distribution on brightness output phosphor or the charge distribution on the signal plate then represents the radar energy distributed in range vertically and Doppler horizontally. Author

N67-13080# Columbia Univ., New York.
ELECTRO-OPTICAL PROCESSOR FOR PHASED ARRAY ANTENNAS
Moses Arm, Louis B. Lambert, and Alexander Aimette *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 345–378 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00
(Contracts AF 49(638)-1113; AF 49(638)-1478)

Results are presented of a theoretical and experimental investigation of electro-optical processing of signals received by a planar array antenna. The signals received by the elements of the array are converted into proportional ultrasonic waves and the resulting Debye-Sears effect is utilized to spatially modulate laser light in the object plane of a coherent optical system. The spatial distribution of light intensity in the image plane is shown to be a replica of the far-field radiation pattern associated with the received signals. All antenna beams are formed simultaneously, unambiguously and without quantization. The implementation of an experimental model, capable of processing signals received by a 576 element square array antenna with a bandwidth of 1.25 mc, is discussed. Experimental data is presented and shown to correspond closely to the theoretically predicted results. Author

N67-13081# Air Force Systems Command, Griffiss AFB, N. Y.
A MORE FLEXIBLE OPTICAL CORRELATOR USING ELECTRO-OPTICAL DOPPLER REPLICAS
Bernard Di Tano *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 379–401 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

This report presents the results of a theoretical investigation of optical signal processing techniques and describes a correlation technique for the processing of radar signals by means of electro-optical devices arranged in tandem. The electro-optical correlator described represents a modification to the correlators presently used in radars. The two-dimensional (range and Doppler) correlation scheme eliminates the film processing by utilizing a second light modulator. A modification in the ultrasonic light modulator configuration is accomplished which enables it to be used as an electro-optical Doppler replica. The two-dimensional optical correlator is a significant breakthrough in the field of radar signal processing because of its decided advantage over its electronic counterpart. The optical correlator is capable of simultaneously resolving multiple targets in both range and Doppler, whereas its electronic counterpart requires a complexity of electronics for comparable performance in only one dimension. The modification of the electro-optical light modulator for use as a completely flexible Doppler mask, adds a new dimension of flexibility to a device heretofore dependent upon photographic masks. Limitations of optical filtering and Doppler mask configuration are presented, as well as the associated electronics. Author

N67-13082# Michigan Univ., Ann Arbor.
ON THE APPLICATION OF MODERN OPTICAL TECHNIQUES TO RADAR DATA PROCESSING
L. J. Cutrona, E. N. Leith, L. J. Porcello, and W. E. Vivian *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 403–418 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00
(Contracts DA-28-043-AMC-00013(E); AF 33(615)-1452; Proj. Michigan)

Coherent optical systems are used for the processing of data collected by sidelooking synthetic-aperture radars. This type of radar, which is useful for fine-resolution terrain imagery, has the capability of providing along-track, or azimuth resolution, which is much finer than the azimuth dimension of the radiated beam itself; however, the attainment of this finer resolution requires extensive processing of the received radar signal. Coherent optical

systems are well suited to such processing, and a simple optical system can readily convert the unintelligible raw data record into a high-quality radar map, an operation which would require considerable equipment if carried out electronically. Author

N67-13084# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass.
NONCOHERENT OPTICAL COMMUNICATION SYSTEM
David E. Wright *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 433–446 (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

Several noncoherent optical communications systems have been developed for the study of line-of-sight voice communications over a range of several miles. Transmitters have been designed employing both high frequency xenon discharge tubes and gallium arsenide optical diodes operated at ambient temperature. The development work involved in driving the optical sources to their high peak power, high repetition rate limits, is described. Several practical configurations of high gain optics at both the transmitter and receiver were investigated. Silicon surface barrier photo-diodes, in conjunction with wideband transistorized amplifiers, are employed to detect and amplify the pulse position modulated signal at the receiver. The battery operated experimental hardware and the field results are discussed. Author

N67-13104*# Wolf Research and Development Corp., West Concord, Mass.
OBSERVATIONAL DATA FORMATS AND IDENTIFICATION OF SUPPLEMENTARY DOCUMENTATION FOR THE NATIONAL GEODETIC SATELLITE PROGRAM
Harry R. Kahler and Normand A. Ray 8 Sep. 1965 57 p refs
(Contract NAS5-9756-8A)
(NASA-CR-80477) CFSTI: HC $3.00/MF $0.50 CSCL 09F

Presented are results of a survey conducted among principal investigators and data collectors associated with the National Geodetic Satellite Program (NGSP). The results of this survey are observational data formats for geodetic/tracking data and an identification of supplementary documentation required for the data analyst. Author

N67-13175*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRACKING SYSTEMS, THEIR MATHEMATICAL MODELS AND THEIR ERRORS. PART II: LEAST SQUARES TREATMENT
W. D. Kahn and F. O. Vonbun Washington, NASA, Dec. 1966 59 p refs
(125-06-02-00-51)
(NASA-TN-D-3776) CFSTI: HC $2.50/MF $0.75 CSCL 17

Described is the development of mathematical models which reflect the effects of tracking system measurement errors (i.e., noise and bias) and tracking system location uncertainties on RMS errors in spacecraft position and velocity. Through the application of the method of weighted least squares, a generalized mathematical model is developed which permits simulation of tracking the spacecraft with several tracking stations in the simultaneous or nonsimultaneous tracking mode. Only simultaneous tracking was considered. Mathematical models are also developed for: (1) effects of a priori knowledge on the RMS errors in spacecraft position and velocity; (2) the ellipsoid of errors in spacecraft position and velocity; and (3) target body impact parameters, the errors in impact position and impact time. The last two models provide the techniques to use when describing the geometry for the RMS errors in spacecraft position and velocity at discrete points along the trajectory and at any targeting or impact point. A numerical example is given which serves to illustrate the effects of known error sources on the RMS errors in spacecraft position and velocity. Author

N67-13206*# Alabama Univ., University. Communication Systems Group.
TAPE RECORDER FLUTTER ANALYSIS AND BIT-RATE SMOOTHING OF DIGITAL DATA
Richard S. Simpson and Robert C. Davis Jun. 1966 92 p refs
(Contract NAS8-20172)
(NASA-CR-80535; TR-8) CFSTI: HC $3.00/MF $0.75 CSCL 09F

An analysis is performed of the effect of flutter on data recorded using instrumentation tape recorders. Flutter is assumed to consist of a Gaussian perturbation in recorder speed and to have a flat power spectral density over the frequencies of interest. Additionally, a system is proposed for smoothing bit-rate variations in digital data due to flutter. The system consists of a buffer with the output rate controlled by the buffer queue length. Such a system would be used in the on-board storage for delayed transmission of data from a space vehicle. Author

N67-13247*# Resdel Engineering Corp., Pasadena, Calif.
THEORY OF PHASELOCK TECHNIQUES AS APPLIED TO AEROSPACE TRANSPONDERS
Floyd M. Gardner and Steven S. Kant [1964] 104 p refs
(Contract NAS8-11509)
(NASA-CR-80567) CFSTI: HC $4.00/MF $0.75 CSCL 09F

A mathematical review, schematics, and an extensive bibliography are presented on the theory of phaselock techniques as applied to aerospace transponders. Some topics discussed are: feedback, stability, noise fundamentals, loop fundamentals, basic loop equations, second-order loops, noise performance, linear analysis, noise threshold, tracking and acquisition, hold-in performance, techniques of acquisition, operation of loop components, limiter performance, phase detectors, voltage-controlled oscillators, optimization of loop performance, construction precautions, internal shielding and filtering, other applications of phase-lock, oscillator stabilization, and discriminators. A typical transponder design is included, along with a detailed description of testing methods. R.U.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N67-12340# RAND Corp., Santa Monica, Calif.
CREATIVE REPRESENTATION WITH REGARD TO OPERATIONAL CORRESPONDENCE AND SEMI-ORDERED SYSTEMS
Norman Gilbreath Sep. 1966 101 p
(Contract AF 49(638)-1700; Proj. RAND)
(RM-5079-PR; AD-639049) CFSTI: HC $4.00/MF $0.75

A description is given of a type of computer program which functions as a conceptual stimulant to augment the imagination of the researcher. The computer input is a class of instance-algorithms whose elements are sets. The computer generates a particular instance-algorithm and several of its elements. The researcher must evaluate results and formulate another class of instance-algorithms to be explored. By specifying only classes whose elements are sets, the researcher allows the computer a freedom to explore areas that initially may not seem interesting-thus creating the possibility of discovering unintuitive properties of the sets. The technique is applied to operational correspondence and semi-ordered systems. Author (TAB)

N67-12415# Joint Publications Research Service, Washington, D. C.
MEANS OF AUTOMATIC DETERMINATION OF CHARACTERISTICS OF POLYDISPERSION SYSTEMS
I. B. Kolmakov *In its* Izv. Vuzov: Instr. Bldg. 12 Oct. 1966 p 65–66 refs (See N67-12401 03-14) CFSTI: $4.00

The determination of the spectrum of the particles of polydispersion systems based on optical information reduces to a solution of the first class of integral equations. Three methods for solving such equations on analog digital computers are reviewed. Author

N67-12416# Joint Publications Research Service, Washington, D. C.
ON THE STRUCTURE (UNIT) SYNTHESIS OF COMPUTERS FOR SPECIAL PURPOSES
Yu. A. Kudryavtsev *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 70–73 refs (See N67-12401 03-14) CFSTI: $4.00

The author expounds in a general form a method for the use of mathematical research equipment for the operations at the stage of unit synthesis of special-purpose computers. Author

N67-12417# Joint Publications Research Service, Washington, D. C.
METHOD OF REMOVING FALSE CODES FOR DECIMAL ANALOG TO DIGITAL CONVERTER OF READING
Yu. S. Sharin *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 74–76 refs (See N67-12401 03-14) CFSTI: $4.00

The author describes a method of eliminating false codes (indeterminacy of readout) for decimal contact analog–digital converters (of the type "N–D", "shaft–digit") based on the principles of the coincidence of code combinations. The method offered has an advantage over the other known methods. Author

N67-12504# Joint Publications Research Service, Washington, D. C.
RELATIONSHIPS BETWEEN DIGITAL COMPUTERS AND CONTROL ALGORITHMS IN COMPLEX SYSTEMS
A. F. Kulakov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 38–45 refs (See N67-12501 03-10) CFSTI: $6.00

A basis is established for the possibility of investigating control algorithms realized on a computer as subsystems having independent value in digital program control systems. The concept of algorithmic control systems and their functioning is introduced. Author

N67-12510# Joint Publications Research Service, Washington, D. C.
MASS QUEUEING SYSTEMS AND RELIABILITY PROBLEMS. THE METHOD OF STATISTICAL INVESTIGATION OF A CLASS OF QUEUING SYSTEMS WHICH ARE MODELS OF DIGITAL COMPUTERS
Ye. K. Degtyarev *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 104–116 refs (See N67-12501 03-10) CFSTI: $6.00

For studying multiphase queueing systems of one class which are models of digital computers it is proposed that we investigate the graph of the sequence of servicing the so-called moduli–elements made up of the set of moduli which is the Cartesian product of the set of devices (phases) times a finite set of demands. The investigation is carried out by methods of plans for partially ordered operations. The recurrent expressions are obtained for the moments of the earliest completion and latest beginning of servicing of the moduli, and also for time reserves for execution of the moduli. The concept of a conjugate model is introduced, which is the analog of the plan of operation with an inverse relationship of the partial order. The results are applicable for investigating the initial queueing system. Author

N67-12518# Joint Publications Research Service, Washington, D. C.
EVALUATION OF THE AVERAGE SEARCH TIME FOR A WORD IN A DICTIONARY USING COMPRESSED WORD CODES AS THE MEMORY ADDRESSES
K. I. Kurbakov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 166–175 refs (See N67-12501 03-10) CFSTI: $6.00

Two procedures are investigated for searching a dictionary. On the basis of the probability model describing the ambiguity of compression of word codes, an estimate is given for the average search time for a word in a machine dictionary. Some results of statistical simulation are presented. Author

N67-12520# Joint Publications Research Service, Washington, D. C.
ARITHMETIC DIVISIBLE CODES WHICH CONTROL ASYMMETRICAL ERRORS AND BUNDLES OF ERRORS
Yu. G. Dadayev *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 214–220 refs (See N67-12501 03-10) CFSTI: $6.00

The problems of correction of asymmetrical errors and bundles of errors in computational processes are investigated. It is shown that finding such codes reduces to the solution of exponential comparison (which is carried out in a simple manner using the concept of a number index) and the simplest Diophantine equations of the type $Ax+By=C$. The conditions of existence of arithmetic divisible codes are presented with correction of bundles of errors of length s. For p_1, $p_2<64$ all the codes are found which correct the bundles of errors of length 5. Author

N67-12617# India. Dept. of Atomic Energy, Bombay.
MULTICHANNEL ANALYSER DATA PROCESSING BY CDC-3600
C. M. Lamba and N. Sarma *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 356–359 ref (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A method of using the computers CDC-160A and CDC-3600 for analyzing spectral data from four detectors is described. The data are recorded in 400 channels of an analyzer and are printed out by an electric typewriter at each energy. Computer processing of the data is favorable because a full excitation function from 2.5 to 5.5 MeV at 5 KeV intervals results in 600 measurements, i.e. 600 × 400 = 240,000 numbers. Described is the machine language program for transferring the data from paper tape to magnetic tape. A second program, on punched cards, gives the relation between the run number and the incident energy, the masses and Q values for each reaction, the angle of observation of each detector, and the calibration data of particle energy vs. channel number for each detector. A sample output from the computer is presented. With minor modifications the program can be used to evaluate angular distribution and angular correlation data. K.W.

N67-12618# India. Dept. of Atomic Energy, Bombay.
THE USE OF ABSOLUTE ERROR ON DATA POINTS IN LEAST SQUARES ANALYSIS
M. Srinivasan and V. Krishnamurthy *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p360–365 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

An approach is presented based on the physical significance or meaning of the estimated error bar on each point for representing experimentally derived data subject to random error by mathematical function. The use of the least squares analysis in this method is demonstrated, and numerical computation on a digital computer by means of a random or pseudo-random code is explained. A random oscillation test is outlined, during which data point configurations are obtained by oscillating the points randomly within the experimental limits of the points using the random code. This is followed by the conventional least squares analysis with each of the configurations. A CDC 3600 digital computer was used in the study, and the concept was tested by applying it to the data of three reactor experiments. K.W.

N67-12855# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
FORTRAN LEXICON AND LIST OF THE SYMBOLIC PROGRAM [LEXIQUE FORTRAN ET LISTE DU PROGRAMME SYMBOLIQUE]
Paule Lemaitre *In its* Programmed Method for the Determination of Propellant Characteristics (Mixed Expansion) 1965 p 127–222 In FRENCH (See N67-12852 03-33) CFSTI: HC $6.00/MF $1.25

A Fortran computer program is presented for use in calculating propellant performance characteristics. Various subroutines, vocabulary, and symbols are explained for operator utilization. A printout in the French language is included. Transl. by R.U.

N67-12860# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
A PROGRAMMED ASSOCIATIVE MULTICHANNEL ANALYSER
G. C. Best Aug. 1966 21 p refs
(AERE-R-5270) HMSO: 5s

An associative storage technique is proposed in which counts locations are allocated only to data channels where events actually occur. The computer used as an associative analyzer has to contain four sets of information: counts data, descriptor list, search information, and program. General program algorithms are presented, and the advantages and limitations of the method are assessed. M.G.J.

N67-12963*# Case Inst. of Tech., Cleveland, Ohio. Digital Systems Lab.
THEORY AND DESIGN TECHNIQUES FOR MAGNETIC-CORE MEMORIES, VOLUME II
Stuart F. Daniels 1966 204 p refs
(Grant NsG-36-60)
(NASA-CR-80352; Rept.-1-66-38, Vol. II) CFSTI: HC $6.00/MF $1.25 CSCL 09B

Coincident current memory considerations and practical linear selection memory configurations are discussed and comparisons made between the two memories. Three examples of special purpose memories are presented: permanent data storage, data delaying and data rate changing memory, and linear selection memory with serial data output. Design considerations and philosophy for current drivers are discussed and examples given, including an information driver using a saturated transistor switch and current pulse generators for a memory core test. Considerations for the design of a sense amplifier are reviewed and examples of existing sense amplifiers are presented. Two core memory decoding logic techniques, used to reduce the necessary combinational logic and the required number of drivers and/or switches, are described. One involves decoding simplifications by connecting the core lines to form a matrix, and the other involves decoding with switch core matrices. A procedure is presented which may be followed in the design of a core memory and an example is given to illustrate its use. R.N.A.

N67-12988*# Texas A&M Univ., College Station.
QUANTIFICATION AND UTILIZATION OF SUBJECTIVELY DETERMINED DATA IN THE CONSTRUCTION OF MATHEMATICAL MODELS
Grady Lee Haynes (M.S. Thesis) Aug. 1966 91 p refs
(Grant NGR-44-001-027)
(NASA-CR-80349) CFSTI: HC $3.00/MF $0.75 CSCL 09B

The development of a model based on the opinions of experts which can be used to obtain information pertinent to the models that are being applied to management and planning decisions for futuristic processes is discussed. The method resembles past efforts in that it uses subjectively determined data as a basis for decisions. Of the two major attempts at using this form of data, DELPHI and PATTERN, the method more closely resembles the former, borrowing from it the technique of non-confrontation of the judges. Resemblance to PATTERN comes from the fact that, while not attempting to rank, the judges are asked to choose one answer from a group of possible answers as being the best. Variance estimates are made, allowing the calculation of confidence bands around the estimates. In an experiment the model was utilized in an attempt to predict cost-time functions for the various cost categories involved in future space programs. C.T.C.

N67-12990*# Case Inst. of Tech., Cleveland, Ohio. Digital Systems Lab.
THEORY AND DESIGN TECHNIQUES FOR MAGNETIC-CORE MEMORIES, VOLUME I
Stuart F. Daniels 1966 155 p refs
(Grant NsG-36-60)
(NASA-CR-80366; Rept.-1-66-38, Vol. I) CFSTI: HC $5.00/MF $1.00 CSCL 09B

A brief history of core memory is given, logical properties and types of square loop magnetic cores are described, and the basic design problem of a magnetic core memory is stated. Some results from magnetic circuit theory are reviewed that are essential to a thorough understanding of square loop cores. It is shown how logical connectives may be implemented using square loop cores by describing possible implementations of the functions AND, OR, and EXCLUSIVE OR for two variables using a single core with an ideally square hysteresis loop. Implementation of the function OR using one core per variable is also described. The symbols and notation for schematically showing memory arrays and the organization of magnetic core memories are described. The practical details of ferrite memory cores are discussed and include the effects of non-ideally square hysteresis loops, memory cores and their describing parameters, and memory core response as a function of input current, size, and temperature. Some of the common ways in which memory core specifications are presented are reviewed, and their interpretation in selecting a core is given. R.N.A.

N67-13090# Praxis Calcolo, S.p.A., Milan (Italy).
APACHE: ANALOG PROGRAMMING AND CHECKING SYSTEM PROGRAMMERS GUIDE
G. Buccari, G. P. Del Bigio, P. Sangermano-Wood (EURATOM) and A. Geranzani Ispra, Italy, EURATOM, Jul. 1966 360 p
(Contracts EURATOM-026-62-2 CETI; EURATOM-031-63-3 CETI; EURATOM-035-64-3 CETI; EURATOM-038-65-3 CETI)
(EUR-3052.e) CFSTI: HC $7.00/MF $1.75

This manual is a guide to the APACHE (Version IV) for the IBM 7090. It has been written to aid system programmers who wish to study the logic and organisation of the program. Author

N67-13105*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GEOS: A OPTICAL MEMORY AND CONTROL UNIT
R. S. Cooperman Sep. 1965 38p Sponsored by NASA
(Contract NOw-62-0604-c)
(NASA-CR-80476; TG-735) CFSTI: HC $2.00/MF $0.50 CSCL 09B

The GEOS optical memory and control unit is a digital delayed command system with a high accuracy real time clock designed to control the operation of the optical beacon. The memory can store up to 59 light flash sequence requests and operates in a 68 hour cycle. The memory is synchronously loaded from the ground without disturbing timing. The one minute scan period of the memory may be set in coincidence with universal time (UT2) by resetting the clock on ground command. A means of digital time normalization of variations in the satellite clock is also provided. Author

N67-13141*# Avco Corp., Lowell, Mass. Space Systems Div.
JPL ENTRY VEHICLE DESIGN COMPUTER PROGRAM USERS' MANUAL
1 Dec. 1966 682 p refs Prepared for JPL Revised
(Contract NAS7-100; JPL-951070)
(NASA-CR-80503; AVSSD-0001-66-RR) CFSTI: HC $9.81/MF $2.75 CSCL 09B

A computer program users' manual is presented to provide understanding of the approximations contained in a series of entry vehicle design programs and of the input procedures. The manual contains a description of each of the seven programs and its specific purpose. The mathematical model used in each program and a list of basic limitations is provided, so that the user can establish the applicability of the program to the problem at hand. The specific equations which are programmed are given, and a section describing the IBM routines is also included. Details are given on information flow, program format, and programming methods. L.E.W.

N67-13184*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER PROGRAM FOR ANALYZING BATTERY PERFORMANCE DATA
G. Halpert [1965] 224 p refs
(NASA-TM-X-55619; X-735-66-385) CFSTI: HC $6.00/MF $1.25 CSCL 09B

A system of computer programs (routines) for processing and analyzing battery and other time-dependent data is presented. The first sections describe the format of the data on punched cards and the mechanism for converting the cards to magnetic storage tape. The third and major section describes the individual analysis routines, instructions to the analyst and computer operator on their use, and the type of output from each. These routines include a means for reducing data, performing mathematical operations, listing, plotting in graphical form, and statistically analyzing the data. Programmers information is found in the appendices. Author

N67-13205*# Arinc Research Corp., Annapolis, Md.
HANDBOOK FOR COMPUTERIZED RELIABILITY ANALYSIS METHOD (CRAM)
W. J. Huck, Jr., D. Van Tijn, and C. W. Duke Oct. 1965 111 p
(Contract NAS8-11087)
(NASA-CR-80536; Publ.-294-22-21-489) CFSTI: HC $4.00/MF $0.75 CSCL 09B

This instruction manual was written for personnel who are using, or anticipate using, the Computerized Reliability Analysis Method (CRAM). A brief description of CRAM is presented from the standpoint of the reliability engineer interested in using a computer facility for the qualitative or numerical solution of complex reliability functions. More detail is given to certain aspects of CRAM programming preparations such as: procedural rules, operating mode coding, coding instruction, element table instruction, failure information table construction, and the computer programs. A coding dictionary, details for certain special considerations such as relay calculations or time dependent system configurations, and an explanation of computer output interpretation are also provided. A.G.O.

N67-13219*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
REDUNDANT SPACECRAFT SEQUENCER BREADBOARD Final Report, 30 Mar.–30 Jun. 1966
30 Jun. 1966 139 Prepared for JPL
(Contracts NAS7-100; JPL-951345)
(NASA-CR-8050; LAD-38552) CFSTI: HC $4.00/MF $1.00 CSCL 09B

Details are given on the design, implementation, and test of a spacecraft sequencer breadboard, which is a redundant version of a portion of the Mariner C sequencer. The design makes use of multiple-line logic, with three copies of each logical design and majority voting circuits at selected points to remove the effects of errors. The breadboard includes the electrical equivalent of a significant portion of the entire redundant sequencer. Low density packaging was used to reduce costs and permit a comprehensive testing program; the circuitry combines integrated and discrete component circuits. The basic functions of the logic, test equipment, and individual circuits are summarized, and test data are presented along with a description of all system modifications. A complete set of detailed system logic diagrams, schematic diagrams, and parts lists are appended. M.G.J.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N67-12339# Army Electronics Labs., Fort Monmouth, N. J.
DRIVE REQUIREMENTS FOR HIGH-VOLTAGE LOW-GRID-CURRENT TUBES
George W. Taylor Aug. 1966 16 p
(ECOM-2734; AD-638790) CFSTI: HC $1.00/MF $0.50

Modern hard-tube modulator structures using a magnetic field to focus the electron beam have reduced the intercepted grid current by an order of magnitude. This has resulted in significant reduction in the required drive power. In order to achieve the full current capability of these tubes during the pulse rise time, the displacement current required to discharge the tube and circuit capacitance between grid and plate must be supplied by the driver. Typical calculations and curves showing the effect of the driver current on rise time are included. Author

N67-12408# Joint Publications Research Service, Washington, D. C.
PRECISION DIFFERENTIAL INDICATOR OF EFFECTIVE VOLTAGE VALUES
M. S. Roytman *In its* Izv. VUZov: Instr. Bldg. 2 Oct. 1966 p 31–35 refs (See N67-12401 03-14) CFSTI: $4.00

In the article, the author analyzes the errors in differential indicators (DI), caused by the presence of harmonics in the voltages being compared. A description is given of the DI based on photoelectrical transformers. The results of experimental checking are included. Author

N67-12538# General Electric Co., Auburn, N. Y. Semiconductor Products Dept.
A PRODUCT ENGINEERING MEASURE FOR THE IMPROVEMENT OF PRODUCTION TECHNIQUES TO INCREASE THE RELIABILITY AND TO IMPROVE PRODUCT CAPABILITY OF HIGH VOLTAGE MINIATURE SILICON RECTIFIERS Quarterly Progress Report, 30 Sep.–30 Dec. 1965
W. R. Comstock, P. C. Whitman, R. R. Schall, and E. G. Teffet
30 Dec. 1965 69 p refs
(Contract DA-36-039-AMC-06157(E))
(QPR-4; AD-631364) CFSTI: HC $3.00/MF $0.75

The work performed includes: evaluation of pellet design experiments performed during the last quarter; adoption of a final pellet design; installation of production equipment and start-up of the manufacturing line; completion of A13 matrix testing through the 2,000-hour readout; design of the A14 life test matrix; finalization of the proposed specification, except for reverse recovery testing; and presentation of environmental and life test data for devices fabricated during the third quarter. Author (TAB)

N67-12672# Minnesota Univ., Minneapolis. Electron Tube Research Lab.
NOISE MEASUREMENTS AS A TOOL IN ELECTRON DEVICE RESEARCH Final Report, 1 Jan. 1963–31 Jan. 1966
A. Van Der Ziel 31 Jan. 1966 204 p refs *Its* Rept.-24 (Contract DA-36-039-AMC-00028(E))
(ECOM-00028-F; Rept.-24; AD-638297) CFSTI: HC $6.00/MF $1.25

The first part of the report reproduces published papers whereas the second part deals with unpublished research. The published papers deal with: (1) apparent noise suppression in thin-film diodes caused by traps; (2) noise suppression in space-charge-limited field-emission cathodes; (3) a Hanbury Browntwiss type circuit for measuring small noise signals against a large noise background; (4) noise in cathodoluminescence light; (5) noise in the light emission and electron emission of MgO cold emitters; (6) noise in field-emission diodes. The unpublished research deals with noise in secondar electron emission, in thin-film cathodes and thin-film devices and in transmission-type secondary emission. The equivalence of the particle and the wave picture of photon noise is shown. Finally there is a section on noise in the light output of a scanned cathoderay tube screen caused by screen inhomogeneities. For the experimental set-up used here the R.M.S. fluctuation in light intensity amounts to a few percent and the noise spectrum extends to about 50 kc/s. Author (TAB)

N67-12678# Illinois Univ., Urbana. Coordinated Science Lab.
A NOTE ON FREQUENCY ENTRAINMENT
Nelson Wax Sep. 1966 22 p
(Contract DA-28-043-AMC-00073(E))
(R-318; AD-638817) CFSTI: HC $1.00/MF $0.50

The synchronization of a finite set of weakly coupled oscillators to a small external signal is studied, using a method proposed by Struble. Difficulties with the problem of small divisors are avoided. Conditions for the existence of stationary oscillations are given, and the stability of these oscillations are investigated. The results are applied to two problems. Author (TAB)

N67-12679# Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF SOLID ELECTROLYTE TANTALUM CAPACITORS Quarterly Report, Mar. 29–Jun. 29, 1966
J. H. D. Folster and E. J. Fresia 29 Jun. 1966 11 p refs
(Contract DA-36-039-AMC-03621(E))
(QR-12; AD-639574) CFSTI: HC $1.00/MF $0.50

New manufacture and testing of the 5.6μF–35V and 33μF–35V ratings were authorized during this period. The remaining seven ratings reached the 6000-hr readout point. Readings from a preselected statistically randomized sample are presented. Author (TAB)

N67-12764# Joint Publications Research Service, Washington, D. C.
INVESTIGATIONS OF THE NATURE OF THE CONDUCTIVITY OF GLUED CONTACTS
A. T. Mel'nichenko *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 12–14 refs (See N67-12761 03-14) CFSTI: $5.00

The possibility of obtaining electrical connections by using nonconducting adhesives is investigated. Results of experimental investigation of the character of conductivity of contacts with adhesive and other films are given. A conclusion is given for the comparability of the values of conductivity through metallic and quasi-metallic spots. Author

N67-12765# Joint Publications Research Service, Washington, D. C.
LIGHT-TRIGGERED BISTABLE CIRCUIT USING PHOTOCAPACITOR
L. S. Berman *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 15–17 refs (See N67-12761 03-14) CFSTI: $5.00

A circuit was developed, which uses a photovariable capacitor (φB) and is switched on and off by light. It has a response threshold of about 3.10^{-3} lumens. The requirements for the parameters of the photocapacitors are listed. Author

N67-12766# Joint Publications Research Service, Washington, D. C.
MEASURING THE FERRITE-CORE LOSSES IN STRONG HIGH-FREQUENCY FIELDS
T. G. Kupatadze *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 18–20 ref (See N67-12761 03-14) CFSTI: $5.00

A description is given of a method for determining losses in cores made of ferromagnetic materials in strong high frequency fields. Author

N67-12772# Joint Publications Research Service, Washington, D. C.
DYNAMIC PROPERTIES OF HYSTERESIS MOTORS WITH PHASE CONTROL
V. N. Drozdov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 46a–52 refs (See N67-12761 03-14) CFSTI: $5.00

An equation is derived for hysteresis motors with phase control by taking into account the transient processes in the stator windings. This equation describes the dynamic properties of motors for SAR (Automatic Control Systems). In using the frequency methods for the analysis and synthesis of SAR with such motors, an harmonic linearization of the equation obtained with the aid of an analog computer is suggested. Author

N67-12938*# Electro-Optical Systems, Inc., Pasadena, Calif. Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO CESIUM RESERVOIR CONTROL UNITS Final Report, 28 Sep. 1965–27 May 1966
W. J. Kearns 10 Jul. 1966 158 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951228)
(NASA-CR-80189; EOS-7011-Final) CFSTI: HC $5.00/MF $1.00 CSCL 09A

Feasibility studies are presented for two cesium reservoir control units used with thermionic diodes. The active control unit consisted of a heater and thermal sensor combined into a unit structure and fitted with suitable mounting hardware for attachment to the diode reservoir. The passive control consisted of a vane-type radiation shield mounted on the reservoir. Attempts were made to fabricate a passive reservoir control that would adequately control the reservoir temperature of the thermionic converter without the need for any electrical power input. In addition, an electrical control that is compatible with flight hardware was fabricated. S.P.

N67-13062# Texas Instruments, Inc., Dallas.
SEMICONDUCTOR OPTOELECTRONIC DEVICES
Edward L. Bonin *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 1–22 (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

A discussion is presented on one of the most promising uses for the semiconductor noncoherent photon emitting diode of the GaAs-Si type, i.e., its combination with a semiconductor photodetector in a single miniature package. The discussion covers the state-of-the-art characteristics of emitting diodes, fabrication

techniques for photon coupled devices, limitations and problems to be overcome, and possible trends for future developments. R.N.A.

N67-13067# Atomic Weapons Research Establishment, Aldermaston (England).
AN IMAGE STORAGE TUBE
A. E. Huston, J. Balderston, and D. A. Procter *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 113–127 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

This paper describes a visual input/electrical output storage tube, capable of storing a single image. The storage target is of the barrier grid type, and the reading beam is generated at the photo-cathode, either by flying-spot scanning using an external cathode ray tube, or by illumination of a stationary spot on the photo-cathode, and scanning the target by internal deflection of the electron beam so produced. The performance in terms of signal/noise ratio and ultimate sensitivity is analysed. An application of the tube to high-speed photography is discussed, and results shown. A two-stage version of the tube has been designed, which has applications in ultra-violet spectroscopy for space research. This tube employs an ultra-violet photo-cathode deposited on a lithium fluoride window, giving spectral sensitivity over the range 1100–2000Å. Results of tests and measurements on these and other ultra-violet photo-emitters are given, together with a progress report on the development of the tube. Author

N67-13092# Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany).
MINIATURIZED BROADBAND E-TEE CIRCULATOR
G. Buchta [1966] 12 p refs Presented at the 12th Symp. of the AGARD Avion. Panel, Duesseldorf, 7–13 Jul. 1966
CFSTI: HC $1.00/MF $0.50

Described is a modified E-Tee three-port circulator with a wide bandwidth of more than 1000 Mc/s for 20 dB isolation at X-band which was achieved in a device with a total length of half an inch. Included is a brief discussion of the structural arrangement broadband characteristics, and high power properties of the miniaturized circulator. S.C.W.

N67-13106*# ITT Federal Labs., Fort Wayne, Ind. Div. of Telephone and Telegraph Corp.
RESEARCH IN THE DEVELOPMENT OF AN IMPROVED MULTIPLIER PHOTOTUBE Final Report
F. H. Barr and E. H. Eberhardt Washington, NASA, 16 Nov. 1966 78 p refs
(Contract NASw-1038)
(NASA-CR-80475; ITTIL-66-1058) CFSTI: HC $3.00/MF $0.75 CSCL 09A

Basic problems and innovations in the design of multiplier phototubes for single event counting were investigated. A new dynode one cascade aperture design was evaluated. The dark noise characteristics of certain photocathode type multipliers were investigated by cathode cooling techniques; the counting properties of tubes in which the instantaneous effective cathode diameter was increased by a new tube design to about 0.4 to 0.5 inches were investigated; and the counting properties and increased effective photon counting efficiencies of tubes especially designed for enhancement of the cathode quantum efficiency by means of multi-bounce optical techniques were investigated. Measurements of pulse response properties of counting tubes were started; and an investigation of multi-electron pulses was started to correct a problem encountered in a new tube design. L.S.

N67-13201*# Westinghouse Electric Corp., Huntsville, Ala.
DESIGN, DEVELOP, FABRICATE AND DELIVER 20-WATT INTEGRATED OSCILLATOR AMPLIFIERS Final Report, 15 Apr. 1965–15 Aug. 1966
15 Aug. 1966 76 p refs
(Contract NAS8-11899)
(NASA-CR-80540) CFSTI: HC $3.00/MF $0.75 CSCL 09C

Details are presented on the fabrication of three 70-watt oscillators and ten 20-watt monolithic oscillators. The silicon epitaxial growth process and evaluation are discussed. The methods of testing and the circuit analysis are described, and it was determined that: (1) High betas permit greater efficiencies in the circuit configuration. (2) Collector emitter saturation and bias resistor losses seem to be the greatest factors affecting efficiency. (3) Greater efficiencies can possibly be obtained by circuit alterations which would decrease biasing and feedback losses. (4) The emitter-base reverse breakdown problem can be eliminated by reducing the amount of feedback voltage. It was concluded that the feasibility of monolithic power integrated circuitry was demonstrated, and that the major difficulties were resolved. N.E.N.

N67-13307# Radio Corp. of America, Princeton, N. J. Conversion Devices Lab.
PHOTOMULTIPLIER INVESTIGATION Quarterly Report, 15 Feb.–14 May 1966
H. M. Smith, Jr. 3 Jun. 1966 22 p
(Contract AT(30-1)-3421)
(NYO-3421-7; QR-6) CFSTI: HC $1.00/MF $0.50

Two problems often encountered by users of photomultiplier tubes today are those of dark pulses and gain shift with count rate or short term stability. Recent investigations of these problems are presented. Studies of afterpulses and their relation to dark pulses have indicated a definite correlation in that ions cause both afterpulses and dark pulses. The source of ions for dark pulses is still somewhat uncertain. High temperature baking of the walls has resulted in some interesting effects on dark pulses. Both types A and B can be reduced significantly by baking while pumping on dark pulses. Both types A and B can be reduced significantly by baking while pumping. Author (NSA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N67-12344# Joint Publications Research Service, Washington, D. C.
A COMPLEX FEEDBACK NETWORK AS THE BASIS FOR AN APPARATUS–ORGANISM SYSTEM MAINTAINING HOMEOSTASIS
A. N. Medelyanovskiy *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 10–16 (See N67-12341 03-05)
CFSTI: $4.00

Automatic control of the quantitative and qualitative characteristics of a prosthesis in relation to maintenance of homeostasis is considered. A representation of the complex feedback network (KSOS) is proposed as the basic functional structure of the natural system for controlling the internal environment of the organism; the applied model may fulfill the functions of the homeostasis automaton maintaining constancy of the indices of the internal environment jointly with the natural control system. The KSOS consists of interrelated control circuits constructed according to feedback principle and containing receptor–effector pairs. Activity is based on support at the level of the system of indices of the internal environment by directives of receptor signals of their state for the biocontrol of the effectors supporting the indices. Differential signals received from other sensors are the basis for optimization of the given levels of indices of the internal environment. L.E.W.

N67-12346# Joint Publications Research Service, Washington, D. C.

PROBLEMS IN THE BIOELECTRICAL CONTROL OF TECHNICAL OBJECTS

A. I. Butko *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 23–27 refs (See N67-12341 03-05) CFSTI: $4.00

The application of biocontrol systems to technical objects is discussed, and the possibilities of bioelectric control of servomechanisms in space by muscular signals are reported. Experiments carried out in this field are summarized, and the results are outlined. Several basic problems were pointed out: encoding and decoding the information, developing efficient artificial means of feedback, training operators to work out the initial bioelectrical signals, and investigating and optimizing dynamic characteristics of bioelectrical control circuits. L.E.W.

N67-12402# Joint Publications Research Service, Washington, D. C.

APPLICATION OF THE ELECTRIC INTEGRATOR FOR MEASURING THE CARRIER LIFETIME IN TRANSISTORS

V. V. Pasynkov, B. Ya. Savel'yev, and A. D. Shinkov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 1–7 refs (See N67-12401 03-14) CFSTI: $4.00

A method of electric modeling for finding the effective carrier lifetime of a charge in a transistor is presented. A relationship is established between the measured carrier lifetime, its geometric dimensions, the lifetime of the carriers in space, and the rate of the surface recombination. C.T.C.

N67-12403# Joint Publications Research Service, Washington, D. C.

DESIGN OF COAXIAL RESONATORS WITH MOVING DIELECTRIC LAYER

B. V. Leshchev *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 8–11 ref (See N67-12401 03-14) CFSTI: $4.00

An equation of the eigen-frequencies of a coaxial resonator, partly filled with a plane-parallel dielectric layer is investigated. One of the possible methods of solving this equation relative to the resonance frequency for oscillations of the TEM type and for dielectrics with slight losses is offered. This limitation permits consideration of the propagation constants as real numbers. Author

N67-12409# Joint Publications Research Service, Washington, D. C.

OPTIMAL CONTROL CASE

D. I. Likerman and V. I. Zlatkin *In its* Izv. VUZov: Instr. Bldg. 2 Oct. 1966 p 36–38 refs (See N67-12401 03-14) CFSTI: $4.00

A solution is presented to the problem of finding the optimum control of an object with the transfer function $K(p)=T_1 p+1/p(Tp+1)$ for the case $T>T_1$. Proceeding from the parameters of the object and the given initial data, it is shown that determinations of the form of the optimal control and the nature of the transitional process can be made without solving the problem as a whole. C.T.C.

N67-12410# Joint Publications Research Service, Washington, D. C.

DEVICE FOR MONITORING THE BLOCKS OF REGULATORS

Ya. F. Shkatov and Ya. Kh. Kalinin *In its* Izv. VUZov: Instr. Bldg. 2 Oct. 1966 p 39–43 refs (See N67-12401 03-14) CFSTI: $4.00

The authors discuss a device permitting a monitoring of the adjustment of all control devices mounted on PAUS units. Dependences are reviewed permitting a determination of the lead time and the isodrome time based on the transition characteristics of the units. Author

N67-12412# Joint Publications Research Service, Washington, D. C.

HYSTERESIS LOOP EFFECT UPON MAGNETIC AMPLIFIER CHARACTERISTICS

N. M. Yakovlev *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 49–54 ref (See N67-12401 03-14) CFSTI: $4.00

It is shown that the hysteresis of the magnetization characteristics appreciably reduces the amplification factor of a magnetic amplifier with an external positive feedback. The hysteresis loop does not exert a perceptable effect on the transient process. Author

N67-12414# Joint Publications Research Service, Washington, D. C.

PULSE-HEIGHT SELECTOR WITH SEMICONDUCTOR TRIODES

V. A. Dolyatovskiy *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 61–65 refs (See N67-12401 03-14) CFSTI: $4.00

A method and device for the selection of pulses by amplitude on the basis of a system of threshold diagrams having logically separated outputs is discussed. A device that has been developed is described and the results of its application are presented. Author

N67-12501# Joint Publications Research Service, Washington, D. C.

TECHNICAL CYBERNETICS, NO. 4, 1966

16 Nov. 1966 317 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, OTN, Tekhn. Kibernetika (Moscow), No. 4, Jul.–Aug. 1966 p 1–200

(JPRS-38864; TT-66-35089) CFSTI: $6.00

In the reports presented, emphasis is focussed on general control theory problems, operations, mass queuing systems and reliability problems, finite automata and computers, information processing, and automatic control. M.G.J.

N67-12502# Joint Publications Research Service, Washington, D. C.

PROBLEMS IN GENERAL CONTROL THEORY. SOME APPLICATIONS OF FUNCTIONAL ANALYSIS IN THE THEORY OF OPTIMAL PROCESSES

R. Gabasov and F. M. Kirillova *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 1–16 refs (See N67-12501 03-10) CFSTI: $6.00

The problem of synthesis of optimal control is divided into three steps: reduction of the variation problem to operations with functions of a finite number of variables; investigation of qualitative problems for optimal processes; and the construction of computation systems. The procedures are described for reduction of the variation problems to finite-dimensional analysis, computational algorithms which are tested on digital computers. In addition to systematizing the known results, a statistical problem and tracing a set of points are investigated. Author

N67-12505# Joint Publications Research Service, Washington, D. C.

RELATIVE EFFICIENCY OF AN OPTIMAL ALGORITHM FOR MULTI-STEP SEARCH

V. V. Akindinov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 46–53 refs (See N67-12501 03-10) CFSTI: $6.00

The structure of the algorithm for optimal construction of a multi-step search procedure is determined, and its power efficiency is evaluated. In particular, the multi-step construction is considered based on a single threshold selection of the probe directions. Author

N67-12506# Joint Publications Research Service, Washington, D. C.
SOME EXAMPLES OF SOLUTION OF OPTIMAL CONTROL PROBLEMS BY THE VARIATION METHOD IN THE SPACE OF THE STATES
I. B. Vapnyarskiy *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 54–63 refs (See N67-12501 03-10) CFSTI: $6.00

Some examples are investigated which show that the variation method in the space of the states permits effective construction not only of classical but also pathological solutions of problems of optimal control (the slip condition of special control). It is shown that if the optimal control is the pathological condition, the numerical methods which use variation in the space of the states permit construction of it with any desired degree of accuracy. The examples are applicable to the solution of specific engineering problems of optimum control by means of digital computers. K.W.

N67-12507# Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF OPERATIONS. PROBABILITY OF OVERLAP OF AN INTERVAL BY A SYSTEM OF RANDOM INTERVALS
Ya. M. Likhterov and L. S. Gurin *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 64–78 (See N67-12501 03-10) CFSTI: $6.00

Probability of overlap of a segment by a system of random segments is investigated. By overlap of a segment is meant the absence in it of a segment of given length, no point of which does not overlap. The solution of the problem is applied to the determination of the probability of detection of an object under cloudy conditions. Author

N67-12508# Joint Publications Research Service, Washington, D. C.
THE MULTINOMENCLATURE PROBLEM OF CONTROL OF RESERVES
Yu. I. Ryzhikov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 79–95 refs (See N67-12501 03-10) CFSTI: $6.00

Discussed is the solution of the problem of optimal control of multinomenclature reserves in the form of a system of multiple supply periods which permits maximum coincidence of the times of orders without an increase in expenses on the stored reserves. An algorithm is presented for selection of the basic period and the multiplicity coefficients. Author

N67-12509# Joint Publications Research Service, Washington, D. C.
OPTIMAL SCHEDULING FOR PARALLEL-SERIES COMBINATIONS OF MACHINES
B. A. Vlasyuk *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 96–103 refs (See N67-12501 03-10) CFSTI: $6.00

Algorithms are obtained for determining the optimal speed for the processing of parts by parallel-series combinations of machines. The following conditions are observed: (1) each machine simultaneously may process only one assembly; (2) if the processing of the assembly is begun on any machine, then, before it is finished, this machine cannot proceed to process another assembly; and (3) the machine on one set cannot begin to process an assembly until it is processed on all the machines of the other set. The problems are mathematically stated and solved, and examples applicable to processes in a metallurgical plant are given. K.W.

N67-12511# Joint Publications Research Service, Washington, D. C.
THINNING OF RECURRENT FLOWS
D. G. Polyak *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 117–126 refs (See N67-12501 03-10) CFSTI: $6.00

Estimates are obtained for some probability characteristics of thinned recurrent flows which are effective in the case of quite rare initial flows. The possible applications are indicated. An example is considered from reliability theory. Author

N67-12512# Joint Publications Research Service, Washington, D. C.
DETERMINATION OF SOME RELIABILITY INDICES OF SYSTEMS WITH REPAIR
B. A. Kozlov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 127–136 refs (See N67-12501 03-10) CFSTI: $6.00

One general problem in the determination of the mathematical expectancy of time of incidence of the system in the absorption state is investigated. The problem, in special cases, may be used in reliability theory and queusing theory. Author

N67-12513# Joint Publications Research Service, Washington, D. C.
CONSTRUCTION OF OPTIMAL PROGRAMS FOR DIAGNOSTICS OF THE STATE OF COMPLEX TECHNICAL SYSTEMS
L. S. Timonen *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 137–146 refs (See N67-12501 03-10) CFSTI: $6.00

For the construction of optimal diagnostic programs for the state of complex technical systems algorithms are proposed based on the methods of dynamic programming, and an evaluation of their complexity is made. The use of the algorithms is illustrated by a numerical example. Author

N67-12514# Joint Publications Research Service, Washington, D. C.
A MAGNETIC ELEMENT WITH A FORKED MAGNETIC CIRCUIT AS THE SELF-REPAIR UNIT OF A REDUNDANT AUTOMATA
V. A. Litvinov and Yu. G. Savchenko *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 147–155 refs (See N67-12501 03-10) CFSTI: $6.00

Some problems in the synthesis of functionally reliable discrete action automata are investigated, in particular the problems of constructing self-repair units. A sufficiently simple realization of devices of this class using magnetic elements with a forked magnetic circuit is proposed. The basis relationships are obtained for the design of the self-repair unit made of transfluxors. Author

N67-12515# Joint Publications Research Service, Washington, D. C.
FINITE AUTOMATA AND COMPUTERS. REALIZATION OF SHIFT REGISTERS
Ye. A. Gurvits *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 156–165 refs (See N67-12501 03-10) CFSTI: $6.00

The problems of realization of synchronous pulse shift registers with minimal and close to minimal numbers of hysteresis elements and various speeds are investigated. Expressions are presented for the numbers of states and elements of the registers. The variables and functions assume positive integral values in these expressions. K.W.

N67-12517# Joint Publications Research Service, Washington, D. C.
THE SYNTHESIS OF RELAY DEVICES WHICH ARE INSENSITIVE TO DAMAGES TO THE ELEMENTS WITH UNRELIABLE INPUT EFFECTS
U. Z. Krishtal' *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 176–184 refs (See N67-12501 03-10) CFSTI: $6.00

The method is proposed for introduction of structural ambiguity into relay devices which provide for direct execution of the prescribed functioning algorithm for damage to the elements of a

relay device controlled by distorted input effects. The proofs are presented for the possibility of minimization and parenthetic form in redundant structures. Author

N67-12521# Joint Publications Research Service, Washington, D. C.
THE RESOLUTION CAPACITY OF SPATIALLY DISTRIBUTED CONTROL SYSTEMS
Yu. I. Samoylenko *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 221–230 refs (See N67-12501 03-10) CFSTI: $6.00

The class of spatially distributed systems for control of the fields of the state of objects with distributed parameters is investigated. In the example of an idealized system for stabilization of the shape of the surface it is shown that under determinant conditions the distributed systems of remote control may have a resolution capacity as high as one might like. Author

N67-12523# Joint Publications Research Service, Washington, D. C.
AUTOMATIC CONTROL. STABILITY OF NONLINEAR SYSTEMS WITH RESTRICTION UNDER RANDOM EFFECTS
K. A. Pupkov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 241–247 refs (See N67-12501 03-10) CFSTI: $6.00

A nonlinear system is investigated with restrictions of random signals at the input. The level of the input signal is defined for which this system loses stability or goes into the condition of autooscillations. The work is developed with respect to processes in nonlinear systems with forced vibrations. An approximate method is proposed for investigating the stability of nonlinear systems under random effects based on joint application of the methods of harmonic and statistical linearization. Author

N67-12524# Joint Publications Research Service, Washington, D. C.
SYNTHESIS OF AN OPTIMAL NONLINEAR CONTROL SYSTEM ACCORDING TO THE MAXIMUM PROBABILITY CRITERION
V. T. Kochetkov and A. V. Potseluyev *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 248–253 refs (See N67-12501 03-10) CFSTI: $6.00

A procedure is discussed for selection of the parameters of a nonlinear control system of given structure which is found under random effects by the criterion of maximum probability of satisfaction of restrictions imposed on the output coordinates of the system (the problem of "rejects"). An example is presented of optimization of the system of angular stabilization of a controlled object on a digital computer. Author

N67-12525# Joint Publications Research Service, Washington, D. C.
STABILITY OF THE PERIODIC SOLUTION OF A CLASS OF NONLINEAR SYSTEMS
V. K. Kutuzov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 254–258 ref (See N67-12501 03-10) CFSTI: $6.00

The stability of the periodic solution is investigated for nonlinear systems having coefficients of the harmonically linearized characteristic equation depending both on the amplitude and on frequency. The analytical condition of stability of the periodic solution of such systems is derived. Author

N67-12526# Joint Publications Research Service, Washington, D. C.
THE DYNAMICS OF SYSTEMS WITH AUTOMATIC ADJUSTMENT OF THE AMPLIFICATION COEFFICIENT USING SEARCH MODULATION
Yu. I. Alimov and V. K. Obabkov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 259–269 refs (See N67-12501 03-10) CFSTI: $6.00

The exact equations of motion of continuous control systems are derived in spectral terms with extremal self-adjustment of the general amplification coefficient with an almost periodic test signal. The linear links are completely described by their frequency characteristics and it is proposed that we analyze the stability of the investigated system with reference to the differential equations. The equations which are derived are compared with equations obtained by the method of freezing the coefficients. Author

N67-12527# Joint Publications Research Service, Washington, D. C.
EVALUATION OF THE QUALITY OF THE OSCILLATORY TRANSIENT PROCESSES IN HIGH-SPEED SEARCH-FREE SELF-ADJUSTING SYSTEMS
Yu. M. Kozlov *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 270–283 refs (See N67-12501 03-10) CFSTI: $6.00

The method of harmonic linearization is considered for evaluation of the quality of transient processes in search-free SNS [Self-Adjusting Systems] described by differential equations of high order. The procedures, based on separate harmonic linearization of the equations of the basic control circuit and the equations of the self-adjusting circuit, permit analysis of asymmetrical oscillatory processes and consideration of the influence of a slow change in the parameters of the object on the characteristic of the transient process. The solution significantly expands the possible applications of the procedure for analysis of the transient processes in the SNS. Author

N67-12528# Joint Publications Research Service, Washington, D. C.
ANALYTICAL CONSTRUCTION OF OPTIMAL DIGITAL REGULATORS
P. D. Krut'ko *In its* Tech. Cybernetics, No. 4, 1966 16 Nov. 1966 p 284–292 refs (See N67-12501 03-10) CFSTI: $6.00

The relationship of the method of dynamic programming to the variation method is established. It is shown that the problem of analytical construction of digital regulators can be solved by linear algebraic equations. Author

N67-12689# Polytechnic Inst. of Brooklyn, N. Y. Electrical Engineering Dept.
MINIMUM SENSITIVITY DESIGNS
J. J. Bongiorno, Jr. 28 Jul. 1966 22 p refs
(Contracts AF 49(638)-1402; AF 49(638)-1373)
(PIBMRI-1343-66; AFOSR-66-1814; AD-637763) CFSTI: HC $1.00/MF $0.50

The use of a scalar performance index for system sensitivity in the design of feedback control systems and in the design of analog computer simulations of specified transfer functions is justified. The designs obtained are optimum in that the sensitivity index is minimized. That the designs are practical is also demonstrated. Author (TAB)

N67-12762# Joint Publications Research Service, Washington, D. C.
CREATION OF NEGATIVE RESISTANCES IN R-C CIRCUITS
M. Ya. Likhttsinder and V. V. Stepnov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 1–6 refs (See N67-12761 03-14) CFSTI: $6.00

The most widely used method of obtaining negative resistances is connected with the use of active components. Under consideration in this article is a method of providing passive electrical R-C circuits with negative resistances. The outstanding feature of this method is its use of exponential sources of current. Author

N67-12763# Joint Publications Research Service, Washington, D. C.
AUTOMATIC MEASUREMENT OF SIGNAL FREQUENCY BY MEANS OF TWO RESONANCE SYSTEMS
V. V. Mel'nikov and V. P. Seregin *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 7–11 *ref* (See N67-12761 03-14) CFSTI: $5.00

A system consisting of two detuned resonators and amplitude detectors is considered. It shows that the overall output signal of such a system can be used to measure the frequency of signals.
Author

N67-12770# Joint Publications Research Service, Washington, D. C.
ANALYSIS OF DYNAMIC ACCURACY OF SENSITIVE ELEMENTS DURING PARAMETRIC EXCITATIONS DUE TO VIBRATION
Yu. V. Podvinstev, A. P. Chernyshev, and G. G. Sebryakov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 38–42 refs (See N67-12761 03-14) CFSTI: $5.00

Relationships for the errors of sensitive elements during parametric excitations caused by random vibrations were obtained within the framework of correlation theory. It was assumed that the law of distribution of probability densities, which governs the vibration and change in parameters, is close to the normal law. Conditions are given for stable performance of the device. An example is also given.
Author

N67-12773# Joint Publications Research Service, Washington, D. C.
DETERMINATION OF CHARACTERISTICS OF NONLINEAR OBJECTS BASED ON THEIR STATISTICAL FUNCTIONS
A. Sh. Gugushvili *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 53–55 refs (See N67-12761 03-14) CFSTI: $5.00

A method is given of using the statistical properties of the input and output signals to determine the characteristics of nonlinear objects during their normal operation. The parameters of an object are determined by recording one result of a linear programming.
Author

N67-12774# Joint Publications Research Service, Washington, D. C.
ANALYSIS OF STATIC ERRORS OF VOLTAGE QUANTIZERS
Yu. D. Dolinskiy *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 56–61 refs (See N67-12761 03-14) CFSTI: $5.00

Performance features of amplitude comparators used in voltage-digit converters, which perform the coding without converting the voltage into values of another physical nature, are considered.
Author

N67-12776# Joint Publications Research Service, Washington, D. C.
A CRITERION OF THE POSSIBILITY OF OBTAINING A LOGICAL FUNCTION WITH A THRESHOLD ELEMENT
K. A. Blazhkin *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 68–70 refs (See N67-12761 03-14) CFSTI: $5.00

A criterion is offered for checking the ability to realize a specified logical function with a threshold element, based on the Carver theorem of consistent inequalities. It estimates the volume of calculations and compares it with the procedure for checking the intersection of convex hulls of the sets scheduled for separation. It also lists the fields of application in instrument making.
Author

N67-12786# Joint Publications Research Service, Washington, D. C.
A DEVICE FOR CONTROL OF MACHINES FOR EXCAVATING AT A SPECIFIED SLOPE
A. S. Gridin, G. G. Ishanin, and V. D. Nikolayev *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 114–119 (See N67-12761 03-14) CFSTI: $5.00

A description is given of a device for automatic and remote control of various machines for excavating at a given slope with the aid of a beam of light. The article contains brief specifications for this device and the results of its testing under laboratory and field conditions.
Author

N67-12791# Joint Publications Research Service, Washington, D. C.
SELECTION OF OPTIMUM PARAMETERS FOR HEAT CONTROLLERS
V. M. Keyn *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 139–144 refs Presented at the Sci. Tech. Conf. on Systems for Automation of Above-ground Radio Tech. Equipment, Leningrad, 4 Jun. 1964 (See N67-12761 03-14) CFSTI: $5.00

A method is considered of improving the static accuracy of temperature stabilization, which is based on the use of temperature relationships between the elements of the circuit of the thermoregulator and, particularly, that of the resistance of the output transformer's winding. Expressions are given for determining the optimum parameters of the thermal-compensation circuit.
Author

N67-13039# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
THE THEORY AND APPLICATION OF LINEAR OPTIMAL CONTROL Final Report
Edmund G. Rynaski and Richard F. Whitbeck Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1966 210 p refs
(Contract AF 33(615)-1541)
(IH-1943-F-1; AFFDL-TR-65-28; AD-632553) CFSTI: HC $6.00/MF $1.25

Linear optimal control theory has produced an important synthesis technique for the design of linear multivariable systems. In the present study, efficient design procedures, based on the general optimal theory, have been developed. These procedures make use of design techniques which are similar to the conventional methods of control system analysis. Specifically, a scalar expression is developed which relates the closed-loop poles of the multi-controller, multi-output optimal system to the weighting parameters of a quadratic performance index. Methods analogous to the root locus and bode plot techniques are then developed for the systematic analysis of this expression. Examples using the aircraft longitudinal equations of motion to represent the object to be controlled are presented to illustrate design procedures which can be carried out in either the time or frequency domains. Both the model-in-the-performance-index and model-following concepts are employed in several of the examples to illustrate the model approach to optimal design.
Author (TAB)

N67-13050# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
CROWBAR AND POWER CROWBAR CIRCUITS AND THEIR CALCULATION [CROWBAR- UND POWER-CROWBAR-SCHALTUNGEN UND IHRE BERECHNUNG]
H.-J. Belitz and E. Kugler Jun. 1965 51 p In GERMAN
(JUL-273-PP) CFSTI: HC $2.50/MF $0.50

The crowbar circuit permits the control of an ignited condenser discharge by external switching in order to obtain high current pulses of any desired characteristics. The two crowbar circuits considered in this report change the original state of the discharge which is characterized by a fast current rise into another dynamical state of slow current decay. Transient wave forms are computed numerically. A Fortran program is given for these computations.
Author (ESRO)

N67-13085# Siemens and Halske A. G., Munich (West Germany).
COUPLING PROBLEMS BETWEEN TRANSISTOR LOGIC AND ELECTROLUMINESCENCE-PHOTOCONDUCTOR LOGIC
Hans-Norbert Toussaint and Werner Schmidt *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 91–104 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

Electroluminescence-photoconductor logic (hereinafter called EL-PC logic for short) qualifies, among other applications, for use at the output end of transistorized data processing systems. Difficulties arise here, however, in the transition from transistor logic (T-logic for short) to EL-PC logic. They are mostly due to the fact that transistors require a d.c. operating voltage of the order of 10 V, while EL-PC logic calls for an a.c. operating voltage of the order of 100 V. The possible coupling circuits between T-logic and EL-PC logic are discussed and compared with respect to switching time and useful lifetime. Advantageous coupling elements in the group of electrically coupled circuits are the three-layer transistor and four-layer transistor, respectively. In the group of the radiation coupled circuits incandescent lamps and luminescence diodes, respectively, are particularly suitable as radiation emitters. Author

N67-13086# Imperial Coll. of Science and Technology, London (England).
A POSSIBLE ELECTRON IMAGE INFORMATION STORE
A. D. Berg and R. W. Smith *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 105–112 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

An optoelectronic store is proposed in which optical information is converted into electrons at a photocathode. The liberated photoelectrons are accelerated into an equipotential delay region. The identity of electron bunches originating from various parts of the photocathode is preserved by the strong axial magnetic field in which the device is operated. This field constrains the electrons to follow tight helical paths. At each end of the delay section are electron gates which, when closed, trap the electrons and force them to oscillate back and forth between the gates. So the information carried by the electrons is stored, and it appears feasible to store approximately 100 separate electron images at one time, thus giving a total of 10^8 stored bits. When information is required from the store, the gate at the output end is opened in synchronism with the approach of the appropriate electron image. The selected electrons are then accelerated up to several kilovolts and converted into current pulses in the vacuum device. Author

N67-13258*# Connecticut Univ., Storrs.
ENGINEERING ASPECTS OF CONTROL SYSTEM DESIGN VIA THE "DIRECT METHOD" OF LIAPUNOV
Richard Vito Monopoli Washington, NASA, Dec. 1966 150 p refs
(Grants NsG-309; NSF GP-1819)
(NASA-CR-654) CFSTI: HC $3.00/MF $1.00 CSCL 09C

A control system synthesis procedure for linear or nonlinear, time varying, single-input, single-output plants is developed into a useful engineering design technique. It can be applied systematically even though plant parameter variations are large and rapid. Controller design is based on Liapunov's direct method, which guarantees that the plant output approaches the output of a model reference. Problems entailed in practical application of the procedure are investigated, among them plant gain saturations, transducer noise, and disturbance inputs. Use of the technique is demonstrated for a class of plants with soft saturation gain characteristics, under any operating conditions, and for plants with hard saturation gain characteristics with some restrictions on operating conditions. The techniques developed in this report, shown to be effective by computer simulation, are to enhance the utility of the synthesis procedure in practical control problems. K.W.

N67-13294# Polish Academy of Sciences, Warsaw.
DETERMINATION OF COINCIDENCE-CIRCUIT STATISTICAL PARAMETERS BY MEANS OF THE POINT METHOD
Jozef Kaliez Apr. 1966 12 p refs
(INR-703/III/PL)

A mathematical method allowing determination of the resolving time, jitter breadth and efficiency of the two-fold coincidence circuit is described. The method may be used at the assumption of Gaussian jitter distributions and is an alternative to the earlier published G-parameter method. Exact graphs and an example illustrating the method are given. Author (NSA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N67-12303*# Centre National d'Etudes des Telecommunications, Issy-les-Molineaux (France).
DESCRIPTION OF THE INSTALLATIONS AT THE PLEUMEUR-BODOU SPACE COMMUNICATIONS STATION
M. J. Dautrey *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 1951–1988 (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

The Pleumeur-Bodou, France, telecommunications station is equipped to study all problems connected with active satellites by link performance, acquisition, tracking, telemetry, and command. It constitutes the basic facility for experimental studies of space communication systems in France. Detailed descriptions of the station's site, overall design, buildings, and operational requirements are given with emphasis on the command tracker, the terminal equipment, the simulator equipment of its boresite tower, and its power supply system. G.G.

N67-12306*# Post Office Engineering Dept., London (England).
THE POST OFFICE COMMUNICATION SYSTEM GROUND STATION AT GOONHILLY, CORNWALL
W. J. Bray and F. J. D. Taylor *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2059–2076 Reprinted (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

The post office satellite communication system ground station in Cornwall, England, is particularly suitable for transatlantic communications. It employs an 85-ft diameter steerable paraboloidal-reflector dish aerial; transmitters; low noise receiving equipment; terminal equipment for transmission and reception of multi-channel telephone; telegraph and television signals; video; multi-channel telephone telegraph links to the trunk network; and support communications for the transmission of data and other information via projects Relay and Telstar. G.G.

N67-12309*# Post Office Engineering Dept., London (England).
BEAM-SWINGING FACILITIES FOR THE GOONHILLY SATELLITE-COMMUNICATION AERIAL
C. F. Davidson and W. A. Rawlinson *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2117–2126 Reprinted (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

The general arrangement of the beam-swinging mechanism to steer a tracking aerial by means of predicted data computations encorporates motions about gimbals controlled by hydraulic pistons mounted orthogonally in the main frame, and around those placed midway on the feed support tube for a conical scan motion. The conical scan motion is applied at the onset of the satellite pass. If the radial display reveals any offset of the satellite trajectory

from the aerial beam, a hand control is used to steer the beam exactly on the course of the satellite. If the divergence of the beam from the boresight axis of the aerial is more than about 4 ft., then azimuth and/or elevation corrections to the predicted course of the aerial are performed by the aerial controller. G.G.

N67-12315*# Post Office Engineering Dept., London (England).
A LOW-TEMPERATURE THERMAL NOISE SOURCE FOR USE AT THE GOONHILLY SATELLITE-COMMUNICATION EARTH STATION
H. N. Daglish *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2195–2199 Submitted for Publication (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

A matched waveguide termination was required as part of the noise temperature calibration facility in the receiving system at the Goonhilly earth-station. For routine measurement of overall system noise temperature, this termination is at ambient temperature. For other noise measurements, and in particular for the measurement of the effective input noise temperature of the maser, the waveguide termination is cooled to 77°K by immersion in liquid nitrogen. Author

N67-12607# India. Dept. of Atomic Energy, Bombay.
A THREE PORT HOLE BEAM SWITCHING MAGNET
U. T. Raheja, E. Kondaiah (Tata Inst. of Fundamental Res.), T. P. David, and P. J. Bhalerao *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 312–315 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The dimensions and performance of a beam switching magnet are discussed, and field requirements for beam switching are presented. The magnet is fitted with six coils connected in series, and it is designed for continuous operation with normal air cooling at room temperature. Tests conducted showed the current stability to be within ±1% in spite of slow current drifts and heating of the magnet. The field was uniform within ±1% up to a radius of 5" from the center in the pole gap. S.P

N67-12608# India. Dept. of Atomic Energy, Bombay.
CONSTRUCTION OF AN ELECTROMAGNETIC ISOTOPE SEPARATOR
K. K. Damodaran and S. R. Gowariker *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 316–320 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A schematic diagram is presented for an electromagnetic isotope separator that is capable of separating isotopes of light, medium, and heavy mass numbers in milligram quantities. It has the provision for using three different types of ion sources: solid charge, gaseous charge, and the sputtering type suitable for charge materials with extremely high melting points. The working principle of all these ion sources is based on ionizing the vapors of the substance to be separated by a strong beam of electrons and extracting the positive ions from the plasma by suitable electrostatic field. S.P.

N67-12609# India. Dept. of Atomic Energy, Bombay.
A SPLIT POLE MAGNETIC SPECTROGRAPH
M. N. Viswesvariah and N. Sarma *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 321–325 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The properties of a split pole magnetic spectrograph, which gives a strong vertical focusing, are discussed. The strong vertical focusing is achieved by the predetermined fringing fields at four pole boundaries instead of two as compared with other spectrographs. The net effect of this is to improve the signal to background ratio of the instrument. The increase in intensity of the beam reaching the focal plane further enables the use of solid-state detectors at the focal plane for coincidence studies. The split-pole spectrograph employs a circular sector pole face and a straight sector pole face with a gap between them to bring about the extra fringing fields. The theory of such a pole shape is briefly considered. S.P.

N67-12610# India. Dept. of Atomic Energy, Bombay.
DEVELOPMENTS IN THE ION BEAM HANDLING FACILITIES AT THE VAN DE GRAAFF ACCELERATOR
T. P. David, M. Bhatia, N. S. Thampi, G. V. Bhat, R. P. Kulkarni et al *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 326–329 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Characteristics of a magnetic quadrupole lens for use in high resolution experiments requiring well collimated beams are described. Since the focusing effect of a lens in one plane is always accompanied by a defocusing effect in the perpendicular plane, the system is a combination of two lenses phased by 90° to obtain focusing in both X and Y planes. A brief description of a method of processing unserviceable ion sources for the Van de Graaff accelerator is presented. S.P.

N67-12611# India. Dept. of Atomic Energy, Bombay.
EFFICIENCY OF A GETTER-ION PUMP
K. B. Nambiar and A. S. Divatia *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 330–333 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Information pertaining to getter-ion pump efficiency was obtained from outgassing studies, the performance of getter materials, and the distribution of the getter material on chamber walls. Titanium, copper, and aluminum were tested in the pump as getters. Although aluminum readily formed compounds with active gases like oxygen and nitrogen, its gettering efficiency was low. Copper failed to establish any pumping action, and the pressure rose continuously. Of all the metals titanium was the most efficient because of its stability at room temperature, its low vapor pressure at high temperatures, and its high gettering efficiency for many gases. S.P.

N67-12695# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Porz (West Germany). Institut fuer Raumsimulation.
PLANNING OF THE SOLAR SIMULATION EQUIPMENT FOR THE LARGE SPACE SIMULATION PLANT OF THE DVL [DIE PLANUNG DES SONNENSIMULATIONSGERAETES FUER DIE GROSSE WELTRAUMSIMULATIONSANLAGE. DER DVL]
Andreas Kalt Sep. 1966 84 p refs In GERMAN; ENGLISH summary
(DLR-MITT.-66-15; DVL-557) CFSTI: HC $3.00/MF $0.75

Following a brief description of the DVL space simulation plant, the most interesting characteristics of a solar simulation equipment are outlined and the possibilities for achieving these characteristics according to the standard of technique are explained. A description of the presented propositions as well as of the solar simulation equipment to be built follows a specification draft for such equipment, taking into consideration the characteristics and conditions of the DVL space simulation plant which is at present under construction. Author

N67-12872# Stanford Univ., Calif. Linear Accelerator Center.
TWO-MILE ACCELERATOR PROJECT Quarterly Status Report, 1 Jan.–31 Mar. 1966
Jun. 1966 88 p refs
(Contracts AT(04-3)-400; AT(04-3)-515)
(SLAC-65) CFSTI: HC $3.00/MF $0.75

The status of the Stanford Linear Accelerator and associated facilities is summarized, together with support activities. NSA

N67-12879# California Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT 49, JANUARY–MARCH 1966
Kenneth C. Crebbin, Fred H. G. Lothrop, and Robert Frise 24 May 1966 20 p refs
(Contract W-7405-ENG-48)
(UCRL-16809) CFSTI: HC $1.00/MF $0.50

The beam was on for experimenters 87.1% of the scheduled operating time. During the second half of 1965 a beam loss at 40 to 50 msec after injection had sporadically appeared and disappeared, causing a number of hours of lost operating time. It was determined this quarter that the new values of pole-face-winding currents set in July 1965 were in part responsible for this loss. By changing to a previous set of operating values, we were able to eliminate this sporadic loss, and have had no further outages due to early beam-loss problems. Damage was discovered in the epoxy coil potting on the septum of the first magnet in the external proton beam extraction system. It was not clear whether it was a radiation, thermal, or potting problem. A noise pickup problem that existed for some months was eliminated in the Bevatron beam induction-electrode system by the installation of a new cathode-follower circuit. This permitted use of the radius feedback system (Autotrack) to control the radial position of the beam during acceleration. The Autotrack system is necessary for beam tracking through a new mode of magnet pulsing known as mezzanine. Final tests of this mode of pulsing were made and mezzanine is about to become an operating mode at the Bevatron. Author (NSA)

N67-13019*# Marshall Labs., Torrance, Calif.
SURVEYOR EJECTA DETECTOR MODEL ML 256-1 AND 185-1 AND SURVEYOR EJECTA DETECTOR GROUND SUPPORT EQUIPMENT MODEL ML 260-1 Final Engineering Report
R. Carden, D. Rose, H. Rosenberg, and D. Sassa [1966] 159 p
(Contract NAS5-3417)
(NASA-CR-79306; ML/TN-2300.55) CFSTI: HC $5.00/MF $1.00 CSCL 22D

The design philosophy and detailed engineering analyses are presented on the ejecta detector electronic instrumentation for dust particle detection on the Surveyor Lander; the ground support equipment (GSE); and the battery operated calibrate units. The instrument sensor consists of an acoustical sensor with an output proportional to, or related to, the momentum of the particle, and a thin film capacitor detector. Fabrication and test data are detailed. The functions required of the electronics packages are listed as: (1) amplify sensor signals and convert them into a binary form compatible with the spacecraft telemetry system; (2) store data until a new impact occurs and count acoustic and film signals; (3) supply inflight calibration signals; and (4) convert spacecraft power into various regulated voltages. The GSE units were built to simulate all spacecraft power and signals; to provide simulated impact signals to the sensor, and visual display of experiment outputs; and to operate on external batteries. Also supplied were three battery operated calibration units which can be plugged into the sensor electronics when the experiment is on the spacecraft to supply five additional calibration signals. M.G.J.

N67-13025*# Scientific-Atlanta, Inc., Atlanta, Ga.
EVALUATION OF THE NASA-KSC-MILA RF BORESIGHT TEST FACILITY AT X-BAND AND S-BAND Final Report
T. J. Lyon, S. F. Hutchins, C. S. Young, and J. S. Hollis May 1966 384 p refs
(Contract NAS10-2103)
(NASA-CR-80430) CFSTI: HC $7.00/MF $1.75 CSCL 14B

The report presents results of a program of theoretical and experimental investigation of the MILA RF Boresight Test Facility. The objectives of the program were to determine the performance of the range in the elevated and ground-reflection modes of operation at X- and S-bands, and to investigate the compatibility of the range capabilities with the Lunar Excursion Module rendezvous radar and landing radar pre-launch test requirements. Experimental results are presented to demonstrate the capability of the range for obtaining high-accuracy boresight and radiation pattern measurements at X- and S-bands. A study of the rendezvous radar and landing radar test problems is presented, and the range compatibility with specific test requirements is discussed. Theoretical developments pertinent to the program are included as appendices. Author

N67-13027# Heliodyne Corp., Los Angeles, Calif.
PROGRESS ON SAPAG FACILITY, III
Roy S. Hickman, Horace A. Ory, and I. R. Tannenbaum Jun. 1964 33 p
(Contract DA-04-495-ORD-3574(Z); ARPA Order 360-62; Proj. Defender)
(RN-15; AD-639298) CFSTI: HC $2.00/MF $0.50

Heliodyne corporation is investigating the ionization and radiation properties of reentry vehicle materials under conditions which simulate those of actual flight. The experimental program involves the preparation of representative materials into sub-micron sized particles under carefully controlled conditions, the injection of these particles into a shock tube, and the measurement of electron density and radiation as a function of distance behind the shock. From the results obtained, the chemical kinetics of the ablation process and the phenomenology of reentry observables can be elucidated. For this reporting period, refinements in apparatus and techniques for the production of ultra-fine particles, particularly of organic ablators, are described. Representative photomicrographs of powder preparations, as well as number density distribution curves, are presented and discussed. The results of light scattering investigations of aerosol distribution and stability are analyzed. Further modifications to the facility, based in part on the results of the above studies, and further development of instrumentation, are also included. Author (TAB)

N67-13136# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
EVALUATION OF WIRELESS CONTROL SYSTEM FOR AIRPORT AIDS Final Report
Robert B. Frack Sep. 1966 30 p refs
(RD-66-64)

Laboratory and field tests were conducted to determine if a wireless control system could satisfactorily replace existing underground wiring circuits for control of airport lighting aids. Test results indicated the system was unstable, subject to interference from external RF noise, and unable to provide simultaneous reliable three-channel operation. Interface units were designed to operate airport lighting aids utilizing the signal developed at the output of the system remote station. Operational testing of the system was cancelled due to its unreliable operation. It was concluded that the system, in its present design, was not suitable as a replacement for underground wiring circuits to control airport lighting aids. A recommendation was made that the system not be utilized for control of airport lighting aids. Author

N67-13179*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
DEVELOPMENT OF A GENERAL PURPOSE AIRBORNE SIMULATOR
John Kroll, Rudy H. Arendt, and Francis E. Pritchard Washington, NASA, Nov. 1966 143
(Contract NAS4-607)
(NASA-CR-641) CFSTI: HC $3.00/MF $1.00 CSCL 14B

This report summarizes the major design, analysis, and test efforts performed, during the development of the variable stability system for the General Purpose Airborne Simulator (GPAS). The GPAS is a JetStar incorporating a variable stability system that can operate in two modes, as a model-controlled system

(MCS) and as a response feedback system (RFS). The theory and operation of both systems are discussed, but since the MCS is considered the primary system, it is given the most attention. The RFS is considered a backup system but it can also be used to augment MCS performance. Methods for computing MCS control loop gains are described. Functional and detailed designs are described for the major GPAS subsystems, the flight control system, variable feel system, pilot's instruments and control panels, airborne computer, test engineer's console, and data acquisition system. In addition, results are presented from the preliminary ground and flight test programs which illustrate the performance of the GPAS variable stability system. Author

N67-13261# Cambridge Electron Accelerator, Mass.
[THE CEA 6-BILLION-ELECTRON-VOLT SYNCHROTRON] Semiannual Report, 1 Jul.–31 Dec. 1965
13 Jul. 1966 7 p refs
(Contract AT(30-1)-2076)
(CEAL-1031) CFSTI: HC $1.00/MF $0.50

A report is presented on the activities of the Cambridge 6-Bev Synchrotron group during latter part of 1965. Topics discussed are policies of the laboratory, explosion and fire of July 5, 1965, experiments, new 100 Mev linac, project BYPASS, and safety. NSA

N67-13290# Atomic Energy Centre, Dacca (Pakistan).
A DUAL-PURPOSE UNIT FOR HIGH VACUUM PUMPING SYSTEM AND LEAK DETECTION IN VACUUM CHAMBERS
J. C. Dutt, M. Rahman, A. Sabir, and M. Roberts Mar. 1966 25 p refs
(AECD/EP/11)

An apparatus using conventional mechanical and vapor-stream pumps was built which can be used as an exhaust system as well as a leak detector. Constructional principles and working instructions are given separately for the pumping and leak detection applications. The apparatus enables the evacuation of large chambers to a pressure of 10^{-5} torr; lower pressures (down to 10^{-7} torr) may be attained if the rotary pump is matched with the diffusion pump. NSA

N67-13312# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SPARK AND STREAMER CHAMBERS AND METHODS OF DATA DERIVATION FROM THESE CHAMBERS [ISKROVYE I STRIMERNYE KAMERY I METODY VYVODA DANNYKH S NIKH]
A. F. Pisarev 1966 18 p refs In RUSSIAN
(JINR-P-2745)

Methods of track particle detection by means of spark chambers are reviewed. The history of creation and development of spark and streamer chambers, their characteristics and ranges of application are considered. Modern methods of filmless extraction of information by using vidicons, light and sonic transducer, electrophotographic layers, wire and other systems are analyzed. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N67-12637# Aktiebolaget Atomenergi, Stockholm (Sweden).
ON SHEAR STRESS DISTRIBUTIONS FOR FLOW IN SMOOTH OR PARTIALLY ROUGH ANNULI
B. Kjellstroem and S. Hedberg Aug. 1966 67 p refs
(AE-243) CFSTI: HC $3.00/MF $0.75

It is commonly assumed that for turbulent flow in annuli the radii of zero shear and maximum velocity are coincident. By inspection of the differential equations for such flow and by an integral analysis it is shown that this is not necessarily true. To check whether important differences could occur, experiments were made in which velocity and shear stress distributions were measured in one smooth and two partially rough annuli. The results show no difference in the radii for the smooth annulus, but for the partially rough annuli there was a small but significant difference. This difference explains the breakdown of Hall's transformation theory reported by other investigators. The error introduced by use of Hall's theory is however small, of the order of 10% or less. Author

N67-12760*# Martin Co., Denver, Colo.
CRYOGENIC LIQUID EXPERIMENTS IN ORBIT. VOLUME II: BUBBLE MECHANICS, BOILING HEAT TRANSFER, AND PROPELLANT TANK VENTING IN A ZERO-GRAVITY ENVIRONMENT
Jay L. Mc Grew and B. K. Larkin Washington, NASA, Dec. 1966 98 p refs
(Contract NAS8-11328)
(NASA-CR-652) CFSTI: HC $2.50/MF $0.75 CSCL 20M

The behavior of bubbles in a zero-gravity environment was investigated. Liquid flow around bubbles, which flow results strictly from surface tension gradients, was shown to cause an appreciable net force on the bubble. Theoretical prediction of the bubble force was made and was found to agree very well with experimental results. Temperature induced liquid flow around bubbles as a heat transport mechanism was also investigated. Liquid flow and temperature patterns were studied by use of various optical techniques. The growth and departure of boiling-produced vapor bubbles were studied. In addition phenomena of zero-gravity venting with boiling liquids were investigated. Freon and liquid hydrogen were used as test fluids in drop tower experiments. Author

N67-12794*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL PERFORMANCE OF A CONICAL PRESSURE PROBE AT MACH NUMBERS OF 3.0, 4.5, AND 6.0
John D. Norris and P. Kenneth Pierpont Washington, NASA, Dec. 1966 22 p refs
(NASA-TN-D-3719) CFSTI: HC $1.00/MF $0.50 CSCL 01A

A wind-tunnel investigation was conducted at Mach numbers of 3.0, 4.5, and 6.0 to study the performance of a previously calibrated conical pressure probe in determining local two-dimensional flow properties. The pressure probe was investigated in compression and expansion flow fields generated by a two-dimensional flat plate. A comparison was made between the local flow properties obtained by use of the pressure probe and those calculated by simple theory. The results indicated that, in general, the values of Mach number and total pressure determined from the probe measurements agreed with the theoretical values within the calibration uncertainty. Also, flow angles determined from the probe-measured pressures agreed with those calculated from simple theory when account was taken of the flat-plate boundary layer, except for the local flow angle in an expansion field. This discrepancy in an expansion field was not resolved. Additional information in the form of schlieren photographs of the flow field was a significant aid in interpretation of results when the probe was near a disturbance. Author

N67-12856# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.

FUNDAMENTAL EXPERIMENTS ON THE TURBULENT REATTACHMENT ON A SUPERSONIC JET [EXPERIENCES FONDAMENTALES SUR LE RECOLLEMENT TURBULENT D'UN JET SUPERSONIQUE]

Maurice Sirieix, Jean Mirande, and Jean Délery 1966 34 p refs In FRENCH Presented at the AGARD Specialists Meeting on Detached Discharges, Rhode St. Génèse, France, 10–13 May 1966

(TP-326(1966)) CFSTI: HC $2.00/MF $0.50

In connection with a study of turbulence in a supersonic jet, fundamental results obtained from an investigation of turbulent reattachment are reviewed, and a detailed analysis of recompression presented. Experiments on the initial boundary layer effect were found to give negligible results. The perturbation method showed the existence of two critical points, one of which played a basic role in the reattachment process. Flow characteristics and thickness measurements of the turbulent layer, during reattachment, were made with the interferometer. The similarity law in the evolution of wall pressures is also briefly discussed. Transl. by R.U.

N67-12890# National Research Council of Canada, Ottawa (Ontario). Engine Lab.

AN INVESTIGATION OF THE FLOW PROCESSES IN A CENTRIFUGAL COMPRESSOR IMPELLER

H. S. Fowler Jul. 1966 42 p refs

(NRC-9199; ME-220) CFSTI: HC $2.00/MF $0.50

The flow in the impeller of a centrifugal flow compressor is complex, and is not yet fully understood. A theoretical model of this flow is proposed, from first principles, and an experimental method of investigating the validity of this model is described. An observer is placed in the centre of a large model of the impeller, and by rotating with it is enabled to examine the flow in the impeller passages in great detail. Experimental results obtained by this method are analysed, and some tentative conclusions on the accuracy of parts of the model are put forward. Author

N67-12894# National Aeronautical Lab., Bangalore (India).

ON MASLEN'S SOLUTION FOR INVISCID FLOW PAST BLUNT BODIES

R. Gopinath Jul. 1966 22 p ref

(TN-AE-31-66) CFSTI: HC $1.00/MF $0.50

Maslen's solution for the inviscid flow past blunt bodies at hypersonic speeds was investigated for the presence of singularity, if any, in the sonic region, both for equilibrium as well as non-equilibrium flows. The shock stand-off distance was calculated by the above method and compared with the results available by other methods. The calculated value compared favorably with those by other methods. Also, an attempt was made to determine the shape of the shock wave for a given distribution of entropy behind the shock wave. Author

N67-12914*# Rocketdyne, Canoga Park, Calif.

SUMMARY, STUDY OF PUMP DISCHARGE PRESSURE OSCILLATIONS

E. D. Jackson Oct. 1966 44 p refs

Contract NAS8-20143)

(NASA-CR-80156; R-6693-1) CFSTI: HC $2.00/MF $0.50 CSCL 20D

An analytical investigation was conducted of pump-generated pressure and flow oscillations, and analytical procedures were developed which may be applied to the design and analysis of turbopumps from an oscillation standpoint. The pump blade wake oscillations were studied from the viewpoint of the generation of oscillation waves; the transmission of waves in the pump discharge system; the reinforcement, or superposition, of waves in the pump discharge from multiple sources; and the elimination of waves by acoustic dampers. Initial studies were made of cavitation oscillations by studying the cavity volume of an inducer and its effect on the oscillations. Experimental programs were conducted to verify and supplement certain of the analytical results. A limited experimental study was also made of stall oscillations in an axial and centrifugal pump. Author

N67-12915*# Rocketdyne, Canoga Park, Calif.

STUDY OF PUMP DISCHARGE PRESSURE OSCILLATIONS Final Report

E. D. Jackson Oct. 1966 324 p refs

(Contract NAS8-20143)

(NASA-CR-80153; R-6693-2) CFSTI: HC $7.00/MF $1.50 CSCL 20D

In an analytical investigation of pump generated oscillations, attention was focussed on the pump blade wake oscillations caused by the unsteady velocity field. Among the aspects considered are the generation, transmission, and attenuation of acoustic waves, and the reinforcement of pressure waves in pumps with vaned diffusers. Cavitation oscillation was studied to determine a quasi-steady dynamic behavior of the cavity volume in an inducer, and to define the oscillation characteristics resulting from it. Some experimental data were also obtained for stall oscillations. A method is described for solving the potential flow field in the blade-to-balde plane of a centrifugal impeller, which assumes a two-dimensional flow dependent upon the assumed two-dimensional flow in the meridional plane. Data are also presented on unsteady blade loading in a rotor–stator combination due to the viscous wake effect. Machine-scaled equations and analog computer circuit schematics for data analysis techniques are included. M.G.J.

N67-12932*# Mississippi State Univ., State College. Coll. of Engineering.

RESEARCH STUDY FOR DETERMINATION OF LIQUID SURFACE PROFILE IN A CRYOGENIC TANK DURING GAS INJECTION Quarterly Progress Report No. 9, Jun. 18–Sep. 17, 1966

William D. Mc Cain, Jr., E. H. Bishop, and James T. Smith 17 Sep. 1966 36 p

(Contract NAS8-11334)

(NASA-CR-79731; QPR-9) CFSTI: HC $2.00/MF $0.50 CSCL 20D

Efforts to determine liquid surface profiles in a cryogenic tank focused on construction of a new bubble tank to obtain data in a flow rate region. The entrainment phase of research was directed to studying the influence of the entrapped-liquid viscosity on entrainment of the liquid by air streams. Plots of entrainment versus time for various average air mass flow rates and liquid viscosities are presented. These plots are explained in terms of the liquid flow characteristics in various parts of the test section. The initial results indicated that at high air mass flow rates (greater than 6.66 lbm/min) for the viscosity range of lcp–cp, changes in viscosity have very little effect on entrainment. However, at low to medium (4.11 lbm/min to 6.66 lbm/min) air flow rates increases in viscosity cause significant reductions in entrainment. S.P.

N67-12947# General Electric Co., Philadelphia, Pa. Missile and Space Div.

EXACT SOLUTIONS TO THE NAVIER–STOKES EQUATIONS WITH CURL FREE CONVECTIVE ACCELERATIONS

Sheldon Weinbaum and Vivian O'Brien (APL) Sep. 1966 33 p refs

(R66SD61)

A general analysis in curvilinear streamline coordinates is developed in order to investigate systematically the behavior of all possible two-dimensional axially-symmetric fluid motions with curl

free convective accelerations that are exact solutions to the incompressible Navier–Stokes equation. The analysis includes: (a) all flows where the convective terms vanish, (b) irrotational flows, $\omega = 0$, (c) Beltrami flows, and (d) all other fluid motions that satisfy the kinematic constraint curl $V \times \omega = 0$. Specific solutions are referenced, derived, or deduced by analogy with a related mechanical problem to give the reader a qualitative idea of the physical behavior of a class of motions. New exact solutions are presented for two-dimensional motions with cross flow and axially-symmetric motions with swirl. Author

N67-12950# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
WAVES IN FLUID-FILLED ELASTIC TUBES
John H. Olsen Jun. 1966 69 p refs
(Grant NIHHD-01288)
(Publ.-66-5)

A theoretical and experimental study of large amplitude long wavelength motions of a viscous liquid in long elastic tubes was performed. A one-dimensional model for the flow in which the tube wall moves only radially, and in which only longitudinal pressure gradients and fluid accelerations are important is presented. The effects of fluid viscosity are treated for both laminar and turbulent flow. The governing nonlinear equations are solved by several methods, and the solutions are compared with each other and with a set of accurate experimental data. The results indicate that nonlinear effects due to large amplitude motion are not as large as those found in similar problems in gas dynamics and water waves. Author

N67-12988*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
SOME SHADOWGRAPH EXPERIMENTS WITH A COLD, SUPERSONIC JET
J. Ollerhead Oct. 1966 35 p refs
(Contract NAS8-11312)
(NASA-CR-80362; WR-66-44) CFSTI: HC $2.00/MF $0.50 CSCL 20D

A series of shadowgraphs are presented which show the flow structure and acoustic radiation of a small, cold, supersonic jet. The position of the film is shown to have a significant effect upon the nature of the photographic image but experiments, attempting to "focus" the shadowgraph by means of lenses, are inconclusive. Acoustic wave radiation which is visible in the shadowgraphs takes two distinct forms. The first is a highly directional radiation, generated in a region near the nozzle, whose origin is uncertain but which is tentatively associated with "Mach waves". The second is spherical in nature and originates from a series of highly localized regions in the exhaust stream. These sources are traced to the intersections of standing compression shocks in the flow with supersonically convected turbulence. Author

N67-13014*# Wyle Labs., Inc., Huntsville, Ala.
AIR BLAST PARAMETERS CLOSE TO A LIQUID PROPELLANT EXPLOSION
F. V. Bracco Jan. 1966 31 p refs Presented at the 2d Meeting of the Working Group on Hazard of the Interagency Chem. Rocket Propulsion Group, Sacramento, Calif. 7–9 Dec. 1965
(Contract NAS8-11217)
(NASA-CR-79733; WR-66-3) CFSTI: HC $2.00/MF $0.50 CSCL 20D

The proper system of equations is presented together with the logic of a numerical approach to solve them. To prove the practical importance of a rigorous approach, the magnitude of the near-field pressure is estimated and justified. For the rigorous solution, either the equation of state of the products of the explosion or the detonation velocity as a function of the loading density (or oxidizer to fuel ratio) must be known. The estimated solution has been based on the assumption that the initial air shock velocity is approximately equal to the detonation velocity and has also considered the influence of the explosive mass to energy ratio. The maximum energy release should be determined through an experimental approach. For the proper analysis of the close-field of liquid propellant explosions, it is concluded that the chemistry of the process should be included, that the proper set of equations is numerically solvable, that the shock transmission model should be improved, that the TNT equivalency system is physically incorrect, and that predicted blast pressures based on the use of the TNT equivalency system are overconservative. Author

N67-13086# Lockheed Missiles and Space Co., Palo Alto, Calif.
VISCOUS FLUID FLOW BETWEEN TWO PARALLEL VIBRATING CYLINDERS
I. N. Sadikov [1966] 10 p refs Transl. into ENGLISH from Tr. Mosk. Fiz.-Tekhn. Inst. (Moscow), no. 7, 1961 p 124–135

An exact solution of the Navier–Stokes equations is obtained for the case of nonstationary viscous fluid flow. The results obtained explain the similarity criteria characterizing the relationship between the inertial and viscosity forces during fluid oscillation, as well as a number of peculiarities of the flow between vibrating buckets. Author

N67-13087# Lockheed Missiles and Space Co., Palo Alto, Calif.
APPROXIMATE METHOD OF COMPUTING THE PRESSURE DISTRIBUTION AROUND BODIES OF REVOLUTION AT AN ANGLE OF ATTACK AT SUPERSONIC VELOCITIES
R. I. Shtainberg and V. P. Drozdov [1966] 4 p refs Transl. into ENGLISH from Tr. Mosk. Fiz.-Tekhn. Inst. (Moscow), no. 3, 1959 p 60–65

The method of local cones is proposed for solving the problem of flow around a body of revolution at both zero and low angles of attack. The method might be considered a first approximation in the solution of the problem of flow around a body of revolution. The crux of the local cones method is that the pressure at each point of the body of revolution is assumed to be equal to the pressure on a cone whose semi-apex angle equals the local angle formed by the tangent at the considered point of the countour and the axis. The results of computations using this method compare well with those of other approximate and exact methods. R.N.A.

N67-13111*# Southwest Research Inst., San Antonio, Tex.
EXPERIMENTAL AND THEORETICAL STUDIES OF LIQUID SLOSHING AT SIMULATED LOW GRAVITIES
Franklin T. Dodge and Luis R. Garza 20 Oct. 1966 78 p refs
(Contract NAS8-20290)
(NASA-CR-80471; TR-2) CFSTI: HC $3.00/MF $0.75 CSCL 20D

An analysis is given for liquid sloshing in a rigid cylindrical tank under conditions of moderately low gravitational acceleration; the theory is valid for Bond numbers that are larger than 10. The results are put in the form of an equivalent mechanical model. It is found that both the fundamental sloshing mass and the natural frequency, for a liquid having a zero degree contact angle, are smaller than for the usual high-g sloshing. A series of experiments was conducted to determine the sloshing force and the natural frequency for Bond numbers between 10 and 200. The test results are compared to the theoretical predictions of the mechanical model, and good correlation between theory and experiment is shown. Author

N67-13180*# Martin Co., Denver, Colo.
CRYOGENIC LIQUID EXPERIMENTS IN ORBIT. VOLUME I: LIQUID SETTLING AND INTERFACE DYNAMICS

T. E. Bowman Washington, NASA, Dec. 1966 74 p refs
(Contract NAS8-11328)
(NASA-CR-651) CFSTI: HC $2.50/MF $0.75 CSCL 20D

The dynamic response of a liquid surface to sudden changes in axial or offaxis acceleration was investigated both analytically and experimentally. The analysis was based on potential flow equations, linearized about a plane. A solution was obtained in the form of a Fourier–Bessel series, and was evaluated for a number of cases of acceleration reversal. The experiments, performed in a 75-ft drop tower, consisted of accelerating test specimens downward, relative to free fall, for 2.1 sec. Experiments were performed at settling Bond numbers from 0 to 1730, with nearly flat initial surfaces. Good qualitative agreement was obtained between the results of the analytical and experimental portions of the program. The experimental results provide a valid representation of what would occur in an actual space vehicle tank for the same initial and boundary conditions. Both the analysis and the experiments show that primary aspects of the settling flow are scaled by Bond number. The analysis further shows that these same flow characteristics should be essentially independent of contact angle. Author

N67-13207*# General Applied Science Labs., Inc., Westbury, N. Y.
COMPUTER PROGRAMS FOR A REACTIVE TURBULENT BOUNDARY LAYER–HYDROGEN VERSION
B. Bellow Mar. 1966 102 p refs
(Contract NAS8-20066)
(NASA-CR-80534; TR-586) CFSTI: HC $4.00/MF $0.75 CSCL 20D

Computer programs for the calculation of properties within a constant pressure reacting compressible turbulent H_2–air boundary layer are described. The partial differential equations for energy and species mass conservation are solved with arbitrary initial conditions by an implicit difference technique. A variable wall temperature boundary condition may be specified whereas the conditions at the edge of the boundary layer are constant. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N67-12323# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES IN THE USSR IN 1962
N. A. Vvedenskaya and N. V. Kondorskaya, ed. 17 Nov. 1966 274 p refs Transl. into ENGLISH of the Book "Zemletryaseniya v SSSR v 1962 GODU" Moscow, "Nauka" Publishing House, 1964 p 3–154
(JPRS-38692; TT-66-35116) CFSTI: $6.00

CONTENTS:

1. STRONG EARTHQUAKES ON THE TERRITORY OF THE USSR IN 1962 N. A. Vvedenskaya, N. V. Kondorskaya, and N. S. Landyreva p 5–19 refs (See N67-12324 03-13)
2. EARTHQUAKES OF THE CARPATHIANS O. P. Kostyuk and B. I. Volosetskiy p 20–23 (See N67-12325 03-13)
3. EARTHQUAKES OF THE CRIMEA I. I. Popov, A. F. Kostina, and Z. I. Aronovich p 24–25 (See N67-12326 03-13)
4. EARTHQUAKES OF THE CAUCASUS A. D. Tskhakaya, E. A. Dzhibladz, V. G. Papalashvili, T. M. Lebedeva, O. M. Maysuradze et al p 26–63 (See N67-12327 03-13)
5. EARTHQUAKES OF THE KOPET-DAG R. D. Nepesov, T. N. Kallaur, G. L. Golinskiy, and L. N. Savel'yeva p 64–72 (See N67-12328 03-13)
6. EARTHQUAKES OF CENTRAL ASIA Ye. G. Astaf'yeva, I. V. Gorbunova, V. K. Iodko, A. P. Katok, M. F. Kulagina et al p 73–120 (See N67-12329 03-13)
7. THE SEISMICITY OF UZBEKISTAN L. M. Plotnikova and N. V. Ulomova p 121–127 (See N67-12330 03-13)
8. THE SEISMICITY OF KIRGIZIA Ye. A. Rozova p 128–130 (See N67-12331 03-13)
9. THE SEISMICITY OF THE SOUTHEASTERN PARTS OF KAZAKHSTAN AND KIRGIZIA I. V. Gorbunova p 131–137 (See N67-12332 03-13)
10. THE SEISMICITY OF TADZHIKISTAN A. P. Katok p 138–145 refs (See N67-12333 03-13)
11. EARTHQUAKES OF THE ALTAY AND SAYANS S. I. Masarskiy p 146–154 refs (See N67-12334 03-13)
12. EARTHQUAKES OF THE BAYKAL ZONE L. A. Misharina, K. V. Pshennikov, G. F. Trotsenko, G. I. Perevalova, Ye. O. Fomina et al p 155–190 (See N67-12335 03-13)
13. EARTHQUAKES OF THE FAR EAST S. L. Solov'yev, R. Z. Tarakanov, L. N. Poplavskaya, O. N. Solev'yeva, M. D. Ferchev et al p 191–229 refs (See N67-12336 03-13)
14. EARTHQUAKES OF YAKUTIA V. M. Kochetkov p 230–242 refs (See N67-12337 03-13)
15. EARTHQUAKES OF NORTHERN KARELIA AND THE KOLA PENINSULA G. D. Panasenko p 243–248 refs (See N67-12338 03-13)

N67-12324# Joint Publications Research Service, Washington D. C.
STRONG EARTHQUAKES ON THE TERRITORY OF THE USSR IN 1962
N. A. Vvedenskaya, N. V. Kondorskaya, and N. S. Landyreva *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 5–19 refs (See N67-12323 03-13) CFSTI: $6.00

The epicenters of the strong earthquakes, and the most active regions are identified. Earthquakes with an intensity of M≥4 1/2 are cataloged, and a map of epicenters is included. It was noted that seismic activity in general was lower for 1962 than for previous years. The far East region of Kuril–Kamchatka was the most active area, as usual. The second most active region was found to be Central Asia, where the strongest earthquake (M~7) occurred. The seismic activity in each region is described. N.E.N.

N67-12325# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF THE CARPATHIANS
O. P. Kostyuk and B. I. Volosetskiy *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 20–23 (See N67-12323 03-13) CFSTI: $6.00

Details are given on the seismic activity in the Carpathian region for 1962. The epicenters of all the strongest earthquakes were located in Rumania, at the bend of the Carpathian arc. The foci were at a depth of 100–150 km under the earth's crust. The epicenters of the earthquakes noted directly on the Russian territory were located in the Transcarpathians. A table of the earthquakes is included. N.E.N.

N67-12326# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF THE CRIMEA
I. I. Popov, A. F. Kostina, and Z. I. Aronovich *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 24–25 (See N67-12323 03-13) CFSTI: $6.00
Two strong earthquakes during 1962 in the Black Sea, at a distance of 200–250 km from the Yalta station, and three weak quakes at a distance of 15–40 km are reported. None on the Crimean peninsula were noted. N.E.N.

N67-12327# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF THE CAUCASUS
A. D. Takhakaya, E. A. Dzhibladze, V. G. Papalashvili, T. M. Lebedeva, O. M. Maysuradze et al *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 26–83 (See N67-12323 03-13) CFSTI: $6.00

The main features of seismic activity in 1962 are discussed, and the epicenters are located. A table of the earthquakes is included, giving the time of origin, depth, latitide and longitude coordinates, magnitude, and energy class. The epicenters of the larger magnitude quakes are mapped, and their distribution is described. N.E.N.

N67-12328# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF THE KOPET-DAG
R. D. Nepesov, T. N. Kallaur, G. L. Golinskiy, and L. N. Savel'yeva *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 64–72 (See N67-12323 03-13) CFSTI: $6.00
The local earthquakes are cataloged, and the epicenters are located when possible. It is pointed out that the scarcity of stations in this region permits locating the epicenters of only the stronger quakes. The predominant number of epicenters were located in Iran, and only a few within the borders of the U.S.S.R. A map of the distribution of epicenters indicates that the seismic activity for 1962 agrees well with the recorded activity for the past century. N.E.N.

N67-12329# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF CENTRAL ASIA
Ye. G. Astaf'yeva, I. V. Gorbunova, V. K. Iodko, A. P. Katok, M. F. Kulagina et al *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 73–120 (See N67-12323 03-13) CFSTI: $6.00

A catalog of the 1962 seismic activity noted in the Central Asian region of the U.S.S.R. is presented, and macroseismic information is discussed. The catalog includes time and place of origin, coordinates of the focus, magnitude and energy class, and location of the epicenter. The South Tien-Shan and Pamir-Hindu Kush seismic zones were the most active, as in previous years. The strongest earthquake occurred in Dzungarian Alatua, and its epicenter was located in China. The strongest quake on U.S.S.R. territory was recorded in the Fergana Valley, and descriptions by inhabitants are included. N.E.N.

N67-12330# Joint Publications Research Service, Washington, D. C.
THE SEISMICITY OF UZBEKISTAN
L. M. Plotnikova and N. V. Ulomova *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 121–127 (See N67-12323 03-13) CFSTI: $6.00

Details on the 1962 earthquakes in Uzbekistan are presented. The irregular distribution of epicenters is illustrated by maps of the epicenters and of their densities. It was noted that the foci of strong quakes are located in the zone of increased density. The greatest density of epicenters was to the southwest of Fergana, and the second most dense area was the eastern spur of the Zaalayskiy range. The region of maximum activity was located at a depth of 20 km. Graphs are given of the dependence between the number and energy of quakes and of the elastic deformation characteristics for the Markayskoye regions. N.E.N.

N67-12331# Joint Publications Research Service, Washington, D. C.
THE SEISMICITY OF KIRGIZIA
Ye. A Rozova *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 128–130 (See N67-12323 03-13) CFSTI: $6.00

Seismic activity during 1962 is discussed for the Kirgizia region on Russian Central Asia. It was determined that the predominating number of earthquakes had an energy level index of 9, and for whose magnitude was determined, the value varied between 2.1 and 5.5. The distribution of the epicenters is mapped, and the increased activity in the adjacent Chinese territory is mentioned. N.E.N.

N67-12332# Joint Publications Research Service, Washington, D. C.
THE SEISMICITY OF THE SOUTHEASTERN PARTS OF KAZAKHSTAN AND KIRGIZIA
I. V. Gorbunova *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 131–137 (See N67-12323 03-13) CFSTI: $6.00

The system of earthquake observation, and the accuracy of determining epicenter coordinates are described. A map of epicenters during 1962 for this region in the U.S.S.R. Center Asian area is presented, and it is demonstrated that the energy class of 8 is representative for the territory. It is pointed out that a large number of weak earthquakes were recorded, due to additional expeditionary type stations. The recurrence graphs for strongly and weakly active zones are discussed. N.E.N.

N67-12333# Joint Publications Research Service, Washington, D. C.
THE SEISMICITY OF TADZHIKISTAN
A. P. Katok *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 138–145 refs (See N67-12323 03-13) CFSTI: $6.00

The seismic activity recorded in Tadzhikistan during 1962 is reviewed, emphasizing the deep earthquakes in the Pamir-Hindu Kush region. The seismic stability of this area, and the similarity to the Southern Tien-Shan zone are mentioned. It was noted that the strong quakes occurred in regions of increased weak earthquake activity in both zones. Maps of the epicenters, and a graph of recurrence are presented. N.E.N.

N67-12334# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF THE ALTAY AND SAYANS
S. I. Masarskiy *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 146–154 refs (See N67-12323 03-13) CFSTI: $6.00

The recording of earthquakes during 1962 and the distribution of epicenters are reported. It was found that the greatest number of earthquakes were in the energy class 9, and the class 8 was second. The greatest quantity of quakes of all energy classes was noted in the Sayan-Tuva zone, and the largest number of strong shocks in the Lake Khubsugul region. The seismicity of the eastern and western Sayans and Tarbagatay are mentioned. A map of the epicenters, and a catalog of the quakes are included. N.E.N.

N67-12335# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF THE BAYKAL ZONE
L. A. Misharina, K. V. Pshennikov, G. F. Trotsenko, G. I. Perevalova, Ye. O. Fomina et al *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 155–190 (See N67-12323 03-13) CFSTI: $6.00

A catalog of the earthquakes, and a general description of the seismic features of the Baykal zone in 1962 are presented. It is reported that the seismically active zone coincides with the high mountain belt, as has been the case over a long-term period. The strongest quake, with a magnitude of 6 occurred in the Muyskanskiy range. Other large quakes are mentioned, and a map of the epicenters is included. N.E.N.

N67-12336# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF THE FAR EAST
S. L. Solov'yev, R. Z. Tarakanov, L. N. Poplavskaya, O. N. Solev'yeva, M. D. Ferchev et al *In its* Earthquakes in the USSR in 1962 17 Nov. 1966

The main features of the seismicity in the far eastern region of the U.S.S.R. are discussed, and a catalog of earthquakes is presented. The stations, basically along the chain of volcanoes and west of it, are described, and the methods used in determining earthquake palameters are outlined. Maps of epicenters, projections of foci, and of individual earthquake activity are presented. The stronger quakes are discussed in greater detail. It was determined that: (1) Seismic activity grows to the north and south of the center of the Kuril Islands. (2) A persistent minimum of activity is noted in the vicinity of the Central Kuril Islands. (3) The variation of activity along the arc as an average over many years appears in the form of superposition of two sinusoids. (4) A strong decrease in activity east of Kamchatka in 1962 was recorded. N.E.N.

N67-12337# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES IN YAKUTIA
V. M. Kochetkov *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 230–242 refs (See N67-12323 03-13) CFSTI: $6.00

Seismic activity in the Yakut zone during 1962 is reviewed and a catalog of the earthquakes and a map of the epicenters are presented. The quake of April 19 is discussed in detail, including the direction and manner of propagation and the influence of faults in the region. N.E.N.

N67-12338# Joint Publications Research Service, Washington, D. C.
EARTHQUAKES OF NORTHERN KARELIA AND THE KOLA PENINSULA
G. D. Panasenko *In its* Earthquakes in the USSR in 1962 17 Nov. 1966 p 243–246 refs (See N67-12323 03-13) CFSTI: $6.00

Weak earthquakes are reported for 1962, and the epicenters of only two were determined. Details on the quakes of July 4 and September 28 are presented, and a catalog of all earthquakes is included. N.E.N.

N67-12362# Woods Hole Oceanographic Institution, Mass.
SOME CURRENT MEASUREMENTS IN THE SARGASSO SEA
C. Godfrey Day and Ferris Webster Mar. 1966 15 p refs Repr. from Deep-Sea Res., v. 12, 1965 p 805–314 *Its* Contrib. No. 1513
(Contracts AT(30-1)-2998; Nonr-2196(00)-1)
(WHOI-REF-66-9; AD-631687)

Long-term current measurements at depths of 50 and 100 m obtained with Richardson current meters at two deep-water moorings south of Bermuda are reported. The records are dominated by anticyclonic rotations which appear and degenerate, possibly in response to the passage of storms. Spectral analysis of the records indicates that this motion has a period of 24 hours at a depth of 50 m, and 25×3 hours at a depth of 100 m. No explanation is given to account for this difference in period over a 50-m separation. Both records indicate the existence of semidiurnal tidal motion. The long-term motions at both depths indicate a systematic change in the net direction of flow over a three month period. Author (TAB)

N67-12398# Office of Naval Intelligence, Washington, D. C. Translation Section.
REPORT OF THE INVESTIGATIONS IN THE FIELD OF GRAVIMETRY, CONDUCTED IN THE USSR FROM 1962–1965
Yu. D. Boulanger and L. P. Pellinen 26 Aug. 1966 20 p refs Transl. into ENGLISH from Russian Presented at the Intern. Gravimetry Comm. of the Internal Assoc. of Geodesy, Paris, Sep. 1965
(ONI-TRANS-2191; AD-639186)

Contents: The development of national supporting links and polygons for the standardization of gravimeters; measurement of gravity on the sea and in the air; determination of the shape, dimensions, and gravitation field of the earth; secular variations in the force of gravity. Author (TAB)

N67-12457# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
VESIAC MONTHLY BULLETIN OF VELA UNIFORM RESEARCH PUBLICATIONS
15 Mar. 1966 19 p refs *Its* Vesiac Bull. No. 38
(AD-631058) CFSTI: HC $1.60/MF $0.50

A bibliography of technical reports and translations directly related to the field of seismology is presented. Informative abstracts are included with each citation. A.G.O.

N67-12489# Texas Univ., Austin. Defense Research Lab.
REPORT ON RESEARCH TO INVESTIGATE ATMOSPHERIC INFRASOUND Annual Report No. 2, 1 Jul. 1965–30 Jun. 1966
W. C. Richie and D. R. Chick 13 Jul. 1966 66 p refs
(Contract DA-28-043-AMC-00316(E))
(DRL-A-259; AD-638759) CFSTI: HC $3.00/MF $0.75

The primary content of the report is the presentation of processed infrasonic acoustical data from medium-speed wind, thunderstorms, and several explosion blasts. The data are presented as probability density curves, correlation functions, and power spectra curves. Schematic diagrams and drawings for improvements of previously designed microphones and a new above-ground microphone are included. Author (TAB)

N67-12490# Photo Mapping Wing (MAC) (1370th), Turner AFB, Ga.
RESULTS OF TESTS INVOLVING TRANSFORMATION OF GEODETIC DATA BETWEEN ELLIPSOIDS
21 Mar. 1966 17 p refs
(TR-1; AD-638867) CFSTI: HC $1.00/MF $0.50

The purpose of the tests was to determine the accuracy and the adaptability to electronic and machine computing of two formulas for transformation of geodetic data between reference ellipsoids. These formulas are designed for: (a) transformation of latitude, longitude, and geodetic height. (b) computation of changes in geodetic distance and azimuths due to transformation of coordinates. Author (TAB)

N67-12529# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GEOMETRY AND PATTERNS OF LARGE APERTURE SEISMIC ARRAYS
Richard T. Lacoss 31 Dec. 1965 88 p refs
(Contract AF 19(628)-5167; ARPA Order 512)
(TN-1965-64; ESD-TDR-65-596; AD-628148) CFSTI: HC $8.00/MF $0.75

A study of possible configurations for a Large Aperture Seismic Array has been completed. An array having 21 identical subarrays located on three concentric circles has been found to yield the most satisfactory pattern in wave number space of all the configurations tested. Patterns for some alternative placements of subarrays, including that of the experimental LASA in Montana, have been included in this report. This study of patterns in wave number space has yielded the suggestion that a LASA having a diameter of 200 km should be composed of subarrays from 10 to 15 km in diameter. Such an increase of subarray size above the 7 km diameter subarrays of the experimental LASA would require the use of less regular subarray geometries than those

which have been used in Montana. A sensitivity function for patterns has been developed. This function can be used to predict the change in patterns which might result from changes in seismometer or subarray positions. Since the sensitivity function predicts possible changes in patterns, it can be used to set bounds upon changes in an array which can be made without severely changing the pattern. The tight bounds imposed by the sensitivity function can be relaxed if the pattern resulting from any anticipated change in position is actually computed. Since very little computer time is required to compute a pattern this procedure is highly recommended. Author (TAB)

N67-12838# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Jun. 1966 13 p
(RRC-A132, Pt. 2; SG-5) CFSTI: HC $1.00/MF $0.50

Ionospheric data obtained from vertical incidence soundings from Indian stations are tabulated. Included are lists of the participating stations and cooperating organizations, and tables with data on solar indices, solar flares, solar radio emission, solar flare effects, magnetic storms, and ionospheric effects of solar flares. R.N.A.

N67-12806# Joint Publications Research Service, Washington, D. C.
SOME RESULTS OF ANALYSIS OF DRIFT OF RADIOBEACONS AND DRIFTING AUTOMATIC RADIOMETEOROLOGICAL STATIONS IN THE ARCTIC OCEAN
A. I. Yurokin and Yu. N. Sinyurin *In its* Meteorol. and Hydrol., No. 9, 1966 23 Nov. 1966 p 38–43 (See N67-12801 03-20) CFSTI: $3.00

Operational data on radio beacons adrift on ice and on drifting automatic radiometeorological stations (DARMS) are presented. The installation, mean duration of operation, geographic distribution of stations, and mean distribution of losses of beacons and DARMSs during the year are briefly discussed The application of radio data for determining direction and velocity of sea currents is outlined. N.E.N.

N67-12808*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PEGASUS SATELLITE MEASUREMENTS OF METEOROID PENETRATION, FEBRUARY 16–DECEMBER 31, 1965
Stuart Clifton and Robert Naumann Washington, NASA, Dec. 1966 33 p refs
(NASA-TM-X-1316) CFSTI: HC $2.00/MF $0.50 CSCL 04A

A statistically defensible criterion for the validation of Pegasus satellite data is presented in this report and the observed fluxes are calculated on this basis. The calculated values are then corrected for possible lost counts using the detectability factors determined in laboratory tests. The resulting fluxes are .00487/ m^2 day for the 0.4-mm detectors. .0209/ m^2 day for the 0.2-mm detectors, and .188/ m^2 day for the 0.038-mm detectors. Analysis of the data shows neither a significant correlation of the penetration flux with hour or season nor a definite correlation with meteoric activity, although the possibility exists. The Pegasus data points are shown in relation to other flux models, but a comprehensive discussion of this matter is deferred to a separate report. Author

N67-12824# Finnish Meteorological Office, Helsinki.
MAGNETIC RESULTS FROM NURMIJAERVI GEOPHYSICAL OBSERVATORY
1966 30 p
CFSTI: HC $2.00/MF $0.50

Absolute measurements of magnetic intensities during geomagnetic disturbances which occurred in 1965 are tabulated. Annual mean values of the month, winter, equinox, summer, and year, for the years 1953 to 1965 are also given along with hourly deviations from these mean values. S.C.W.

N67-12827 Joint Publications Research Service, Washington, D. C.
TRANSLATIONS FROM TI-CHIH LUN-P'ING, VOLUME 19, NUMBER 2, FEBRUARY 1959
28 Oct. 1966 84 p refs Transl. into ENGLISH from Ti-Chih Lun-p'ing (Peiping), v. 19, no. 2, Feb. 1959
(JPRS-38369; TT-66-34795) CFSTI: $3.00

CONTENTS:

1. THE GEOTECTONIC OUTLINE OF SINKIANG Ting-p'u Hsiang p 1–27
2. ANALYSIS OF THE MINOR FOLDS IN HO–HSI CORRIDOR Chien-chang Wang p 28–50
3. THE ARCHITECTONIC HISTORY OF EASTERN T'IEN SHAW Chun-chieh Kao p 51–55
4. PRELIMINARY OBSERVATION OF THE NEW STRUCTURAL MOVEMENT IN THE TIDAL WATER BASIN Ti-fan Huang p 56–69 refs (See N67-12828 03-13)
5. ON THE MAGNESIUM CARBONATE CONTROL OF THE FORMATION OF ENDOGENIC BORON BEDS Ch'ing-yu Hung p 70–79 refs (See N67-12829 03-13)

N67-12828# Joint Publications Research Service, Washington, D. C.
PRELIMINARY OBSERVATION OF THE NEW STRUCTURAL MOVEMENT IN THE TIDAL WATER BASIN
Ti-fan Huang *In its* Ti-chih Lun-p'ing, Vol. 19, No. 2, Feb. 1959 28 Oct. 1966 p 56–69 refs (See N67-12827 03-13) CFSTI: $3.00

A preliminary summary of field observations of the new structural movement in the tidal water basins of the southern depression of A-la-shan delta (table) is reported. Discussed are the characteristics and manifestations of the new structural movement, the effect of the new geological structural movement on water systems, and the effect of the structural setup formed in the latter part of the Paleozoic Era and the beginning of the Mesozoic Era on the new structural movement. S.C.W.

N67-12829# Joint Publications Research Service, Washington, D. C.
ON THE MAGNESIUM CARBONATE CONTROL OF THE FORMATION OF ENDOGENIC BORON BEDS
Ch'ing-yu Hung *In its* Ti-chih Lun-p'ing, Vol. 19, No. 2, Feb. 1959 28 Oct. 1966 p 70–79 refs (See N67-12827 03-13) CFSTI: $3.00

Endogenic boron beds in the area of K'uan-t'ien were studied to determine the degree of magnesium carbonate control on their formation. On the basis of analyses of the control of the chemical properties of carbonate on mineralization, the control of geochemical conditions of carbonate on mineralization, and the controlling conditions of carbonate on mineralization, it is concluded that the formation of industrially valuable endogenic boron beds is strictly controlled by magnesium carbonate. Also emphasized is the influence of the lava controlling factor, the structural controlling factor, and the metamorphism of the adjoining rock as a controlling factor for the formation of endogenic boron beds. S.C.W.

N67-12891# Weapons Research Establishment, Salisbury (Australia).
IONOSPHERIC DATA FOR JANUARY 1966 FROM WOOMERA, SOUTH AUSTRALIA
Jul. 1966 24 p ref
(CPD-1966/1/W/) CFSTI: HC $1.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for January 1966. Author

N67-12911*# Consultants and Designers, Inc., Arlington, Va.
ON THE POLARIZATION METHOD OF INVESTIGATION OF TWILIGHT PHENOMENA [O POL YARIZATSIONNOM METODE ISSLEDOVANIY SUMERECHNYKH YAVLENIY]
J. G. Fesenkov 1 Apr. 1966 10 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 43, no. 1, 1966 p 198–203
(Contract NAS5-9299)
(NASA-CR-80158; ST-OA-AI-10468) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A method is proposed, which takes into account the tropospheric component (higher order scattering). It is based on observations of intensity and degree of polarization of the twilight sky in two symmetrical points of the solar vertical. The polarization ratio at these points must be known beforehand hand from preliminary calculations. Formulas for these calculations are derived and their application is given for a simplified model of a twilight segment. Author

N67-12916*# Consultants and Designers, Inc., Arlington, Va.
RATES OF BASIC ION-MOLECULAR PROCESSES IN THE IONSPHERE [SKOROSTI OSNOVNYKH IONNO-MOLEKULYARNYKH PROTESESSOV V IONOSFERE]
A. D. Danilov 17 Aug. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofiz. (USSR), v. 169, no. 2, 1966 p 332–334
(Contract NAS5-9299)
(NASA-CR-80151; ST-AI-10508) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The rate of basic ion-molecular processes is discussed on the basis of the review of twenty-nine works by various authors and the comparison of laboratory experiments with theoretical considerations. Author

N67-12917*# Consultants and Designers, Inc., Arlington, Va.
ON THE MICROWAVE ABSORPTION SPECTRUM OF MOLECULAR OXYGEN [O MILLIMETROVOM SPEKTRE POGLOSHCHENIYA MOLEKULYARNOGO KISLORODA]
A. P. Naumov 8 Dec. 1965 17 p refs Transl. into ENGLISH from Radiofiz. Gor'kovskii Univ., Goiki (USSR), v. 8, no. 4, 1965 p 668–678
(Contract NAS5-3760)
(NASA-CR-80152; ST-MA-RWP-10423) CSCL 04A

An inconsistency is noted in the Maryott-Birnbaum hypothesis about the resonance frequency shift of the microwave spectrum of oxygen absorption for pressures of several atmospheres. It is shown that the approximate accounting for the nonresonance absorption of O_2 is sufficient for the quantitative explanation of the results of measurements of microradiowave absorption at high pressures. The description of the oxygen absorption spectrum in the 5 mm band may be obtained by the standard method for pressures $P \geq 7 \div 8$ atm. Author

N67-12918*# Consultants and Designers, Inc., Arlington, Va.
STUDY OF THE IONOSPHERE LAYERS IN THE INFRARED REGION OF THE SPECTRUM [IZUCHENIYE SLOYEV IONOSFERY V INFRAKRASNOY OBLASTI SPEKTRA]
M. N. Markov, Ya. I. Merson, and M. R. Shamilev 20 Apr. 1966 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofiz. (USSR), v. 167, Apr. 1966 p 803–806
(Contract NAS5-9299)
(NASA-CR-80150; ST-AI-10478) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The study is based upon previous measurements of the Earth's and atmosphere radiation into cosmic space in the infrared region of spectrum from the altitude range 25 to 500 km. The object of the study is to bring forth certain estimates in order to corroborate the possibility, in principle, of fitting the new data into the various other data on the atmosphere. The authors consider as established the fact of the correlation of the ionosphere's infrared emission with flares near the central meridian of the solar disk. Author

N67-12929*# Volt Technical Corp., Washington, D. C.
INTERPRETATION OF MAGNETIC MEASUREMENTS ON "PIONEER-1" AND ITS GEOPHYSICAL CONSEQUENCES [INTERPRETATSIYA MAGNITNYKH IZMERENIY NA "PIONERE-1" I YEYE GEOFIZICHESKIYE SLEDSTVIYA]
M. A. Gintsburg 8 Sep. 1966 12 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 4, no. 2, 1966 p 296–301
(Contract NAS5-12487)
(NASA-CR-80165; ST-PF-GM-10512) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A collisionless shock wave near earth is possible only because it is oblique. An oblique shock wave consists of oblique solitary pulses. The properties of these pulses (amplitude, polarization) as functions of velocity and angle 0 are analyzed. The hypothesis is developed that the acceleration of soft electrons ($E \sim 1$ keV, third radiation belt, aurora electrons, electrons ionizing the night ionosphere), and also of electrons with energies $E \geq 40$ keV (outer radiation belt) precisely takes place in oblique pulses. Experimental corroborations of this hypothesis are brought up together with morphological consequences. Author

N67-12989*# Aracon Geophysics Co., Concord, Mass.
NIMBUS II USERS GUIDE
John B. Howe et al Greenbelt, Md., NASA. Goddard Space Flight Center, Jul. p 230 refs
(Contract NAS5-10114)
(NASA-CR-80361) CFSTI: HC $8.00/MF $1.25 CSCL 04B

General background information about the Nimbus II system is presented, and the experimental sensory subsystems and the class of data anticipated from them are discussed. Included are detailed discussions of the format of the Nimbus II data; data processing, archiving, and availability; and information relative to retrieval services. C.T.C.

N67-12998*# Pennsylvania State Univ., University Park. Ionsphere Research Lab.
D-REGION PROBE THEORY AND EXPERIMENT Scientific Report No. 285
Te-Jin Kuo 30 Nov. 1966 21 p refs
(Grants NsG-134-61; DA-ARO(D)-31-124-G659)
(NASA-CR-80374; SR-285) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A chemistry model for the lower D region at nighttime is discussed, which is confirmed by rocket experiments. The first approximate theory of subsonic blunt probes used in measurments. The first approximate theory of subsonic blunt probes used in measuring ionic conductivities and densities is presented, which is accurate to within 10%. It was discovered through measurements that the negative conductivity exceeds the positive conductivity by some 25%. Author

N67-13016*# Texas Univ., Austin. Electrical Engineering Research Lab.
ESTIMATING REFRACTIVE INDEX SPECTRA IN REGIONS OF CLEAR AIR TURBULENCE
J. J. Stephens and E. R. Reiter 5 Oct. 1966 52 p refs
(Grant NGR-44-012-048)
(NASA-CR-79391; P-12) CFSTI: HC $3.00/MF $0.50

An assessment is made of the spectrum of refractive index fluctuations to be expected in regions of moderate to severe clear air turbulence (CAT). The meteorological aspects of the problem are considered, with background data given on the locations and dimensions of CAT; its mechanism, signature, and structure; and the refractive index spectra. Cumulative distribution data are depicted which show that CAT patches average from 500 to 3000 feet in depth; one-half have horizontal dimensions less than 20 miles. It is also pointed out: (1) The CAT occurs preferentially on the boundaries of shallow, thermally-stable baroclinic zones in the vicinity of the jet stream. A schematic presentation of the variation with flow curvature indicates a preference for occurrence on the cyclone side of the jet core; topographic effects may enhance these frequencies. (2) The refractive index spectrum for scales in the inertial subrange in the presence of CAT can be expressed in terms of the mechanical energy. M.G.J.

N67-13032# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
APPLICATION OF THE METHOD OF MODELS OF THE ANALYSIS OF FORMULAS FOR DETERMINING THE FIGURE OF THE EARTH [PRIMENENIYE SPOSOBA MODEL' K ISSLEDOVANIYU FORMUL OPREDELYAYUSHCHIKH FIGURU ZEMLI]
V. F. Yeremeyev Aug. 1966 97 p refs Transl. into ENGLISH from Tr. Tsentral. Nauchn.-Issledovatel. Inst. Geodezii, Aeros'yemki i Kartografii (Moscow), no. 75, 1950 p 11–77
(ACIC-TC-1062; AD-639111) CFSTI: CH $4.00/MF $0.75

Since, under practical conditions, the distribution of anomalies throughout the whole world is unknown, and gravimetric materials have many errors of gravity measurements and anomalies, four models were used for the evaluation of the errors of the formulas for determining the figue of the earth. The first model is a sphere with constant density, half immersed in a plane of infinite extension (without displacing its mass). The second model is a tore with heterogeneous density, half immersed in a sphere (without displacing its mass). The third model has also the form of a tore and sphere, but here the whole tore is situated within the sphere in order to satisfy the condition of Stokes' problem (lack of exterior masses). The first three models were used for the investigation of formulas based on Stokes' theory and the theory of studies of the geoid of a nonregularized earth. These models are inconvenient for the investigation of the formula determining the figure of the earth's physical surface, because of the discontinuity of the curvature of their exterior surface. Hence, a fourth model was used for the investigation of the latter formula. It had been obtained by the schematization of mount alagez in Armenia (a cone with a flattened vertex set in a sphere). Author (TAB)

N67-13088# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Jul. 1966 13 p refs
(RRC-A133, Pt. 2; SG-6) CFSTI: HC $1.00/MF $0.50

Solar and geophysical data obtained with vertical incidence ionospheric soundings are tabulated. Included are lists of the participating Indian stations and cooperating organizations, and tables of solar indices, solar flares, solar radio emission, solar flare effect, magnetic storms, and ionospheric effects of solar flares. R.N.A.

N67-13102*# Geological Survey, Washington, D. C.
INFRARED SPECTRAL EMITTANCE OF ROCKS FROM THE PISGAH CRATER AND MONO CRATERS AREAS, CALIFORNIA
David L. Daniels Nov. 1966 24 p refs
(NASA Order R-146-09-020-006)
(NASA-CR-80479; NASA-13) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Infrared spectral emittance of natural rock surfaces from the Pisgah Crater and Mono Craters was measured in the 8 to 14 micron wavelength band in an effort to gather data necessary for the formulation of remote sensing identification schemes based upon spectral differences. The aim of this study was to determine if enough of the spectral signature is retained to be recognizable for typical samples of weathered rocks. It was found that: (1) the emittance spectra of weathered surfaces are still recognizable as the spectra of the underlying rock; (2) the emittance spectra of acidic igneous rocks were very similar and were spectrometrically difficult to distinguish one from the other even without the problem of weathering; and (3) there were no significant spectral differences between the two textural varieties of basalt, pahoehoe and aa, from the Pisgah Crater area. S.C.W.

N67-13108*# Miami Univ., Coral Gables, Fla. School of Environmental and Planetary Sciences.
RESEARCH IN ATMOSPHERIC MEASUREMENT TECHNIQUES Semiannual Report
S. Fred Singer Nov. 1966 27 p ref
(Grant NGR-10-007-028)
(NASA-CR-80473) CFSTI: HC $2.00/MF $0.50 CSCL 04A

A systems analysis optimization of a laser experiment designed to detect interplanetary dust in the earth's atmosphere was completed, and a concise summary of the results are given. The analysis indicates that a light-collecting mirror with a diameter of 40 or more inches would be of great benefit, and efforts are being made to obtain such a mirror. The analysis statistics together with given atmospheric scattering cross section data indicate that atmospheric density and atmospheric density changes can be measured by the laser technique. A conceptual plan, based on the Ruby laser and a Raman shifter, for measuring the atmospheric surface pressure by means of a laser from a meteorological satellite was devised. A zodiacal model concerning the interplanetary dust influx into the earth's atmosphere is described, and a summary of distribution functions for zodiacal dust is given. In addition, equations and system parameters for a systems study of a laser atmospheric backscatter experiment are updated and evaluated, and compared to earlier analyses. L.S.

N67-13114*# Northrop Corp., Hawthorne, Calif.
DEVELOPMENT OF TECHNOLOGICAL CONCEPTS LEADING TO THE BENEFICIAL USE OF LUNAR MAGMA PRODUCTS Sixth Technical Progress Report, Jul.–Sep. 1966
E. Azmon Sep. 1966 3 p
(Contract NAS7-358)
(NASA-CR-80435) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Solid-liquid phase transformations of serpentine and olivine were determined in a continuing effort to find a comparison of these minerals with natural dunite. A study of serpentine at 10, 35, and 45 kilobars was conducted. Antigorite, the major constituent of the serpentine, persists at temperatures up to 650°C even at 45 kb; but at lower pressures it seems to persist at temperatures 50 to 75° higher than 650°C. At higher temperatures, olivine is dominant and pyroxene is abundant. The upper temperature limits for this zone rise from 800°C at 10 kb to 900°C at 35 kb to 1100° at 45 kb. At still higher temperatures, pyroxene is dominant. Olivine is abundant up to about 35 kb, but then disappears completely between 35 and 45 kb, and pyroxene is the only crystalline component in the zone. Above this, a 100% glass zone persists. The liquidis curve which is at 1350°C at 10 kb rises to 1450°C at 35 kb and to 1475°C at 45 kb. Two contaminants, boron phlogopite in the 600 to 900°C region at 10 and 35 kb pressure, and boron magnesium oxide at 1450°C at 35 kb, are noted. The data indicate that the temperature dependence of the

de-serpentization is far greater than the pressure dependence. If serpentine is found on the moon, a water extracting process would probably be carried out through temperature manipulation rather than pressure manipulation. L.S.

N67-13158# Environmental Science Services Administration, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.
HYDROMAGNETIC WAVE PROPAGATION NEAR 1 c/s IN THE UPPER ATMOSPHERE AND THE PROPERTIES AND INTERPRETATION OF Pc 1 MICROPULSATIONS
John A. Dawson 30 Jun. 1966 71 p refs
(Contract ARPA SD-183)
(NBS-TN-342) GPO: $0.40

Dispersion and polarization relations are developed from basic considerations for a hydromagnetic wave at about 1 c/s propagating in a cold uniform plasma. The treatment is then extended to include the effects of ion-electron collisions. It is shown that the approximations used are valid in the earth's magnetosphere for heights between 10,000 and 50,000 km (2.6 to 8.8 earth radii). At lower elevations the plasma must be considered as nonuniform. Above 50,000 km the small amplitude assumption is invalid. Finally the theory is extended to include the effects of a multicomponent plasma. Author

N67-13165*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME OBSERVATIONS ON THE THERMAL BEHAVIOR OF THE MESOSPHERE
J. S. Theon, W. Nordberg, L. B. Katchen, and J. J. Horvath (Mich. Univ., Ann Arbor) Oct. 1966 39 p refs
(NASA-TM-X-55621; X-621-66-490) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Temperature and wind soundings of the stratosphere and mesosphere during 1964–65 over Alaska using the acoustic grenade technique are reported. The observations were made over Barrow, Wallops, and Churchill, and simultaneous soundings were made whenever possible. Among the conclusions are: (1) Mesopause temperatures below 150°K are a necessary but not sufficient condition for the existence of noctilucent clouds. (2) Wavelike structures are prominent in the mesosphere temperature profiles at high latitude sites but exist only in wintertime, and their amplitude of oscillation increases with increasing latitude. (3) A stratospheric warming over Barro is explained in terms of the circulation features at 50 km. (4) The amplitude of the diurnal temperature variation in the upper stratosphere at the Equator and at higher latitudes in the Northern and Southern Hemispheres total 8° to 15°C, and the higher temperatures were found near local midnight. N.E.N.

N67-13204*# Alaska Univ., College. Geophysical Inst.
DYNAMO ACTION IN THE IONOSPHERE AND MOTIONS OF THE MAGNETOSPHERIC PLASMA
Ronald N. De Witt Jul. 1965 153 p refs
(Grants NsG-201-62; NSF GP-2721)
(NASA-CR-80537; UAG-R-164) CFSTI: HC $5.00/MF $1.00 CSCL 04A

The kinematics of the dynamo layer are discussed and the motion of the dynamo layer is divided into a symmetric and an antisymmetric part. It is demonstrated that only the portion of the symmetric wind system whch produces ionospheric currents acts against the constraints imposed by the geomagnetic field on magnetospheric motions. The motion of the magnetospheric plasma driven by these wind systems is discussed. A general derivation of the dynamo layer's action is given, and mathematical techniques for solving the dynamo equations for the electrostatic field are developed. The equations for the current driven by the antisymmtric component of wind are derived, and some of the effects of such currents are discussed. It was found that: (1) the conduction alog field lines from one hemisphere to the other is associated with an interhemispheric stress between geomagnetically conjugate point of the order 3×10^{-7} N/M^2, and (2) an antisymmetric layer current density of 5 amp/km into the polar cap region might give rise to a displacement of about 150 km in the relative position of the conuugate points. N.E.N.

N67-13224*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOUND WAVE VELOCITIES IN SOME TEKTITES AND NATURAL GLASSES
C. Ronald Seeger (Pittsburgh Univ.) Jul. 1966 13 p refs Presented at 47th Ann. Meeting of the Am. Geophys. Union, Washington, 19–22 Apr. 1966
(NASA-TM-X-55593; X-640-66-331) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Sound wave velocities in tektites and some other natural glasses have been measured. For tektites they show the same lack of variation as other properties; the compressional wave velocities vary by only about 6%. The other natural glasses show slightly greater variations. This indicates the relative ordering of the internal structures. It is a further indication of the unity of origin of the tektites. Author

N67-13232*# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
LASA SIGNAL PROCESSING, SIMULATION, AND COMMUNICATIONS STUDY Quarterly Technical Report, 14 Feb.–14 May 1966
27 May 1966 53 p
(Contract AF 19(628)-5948; ARPA Order 800)
(ESD-TR-66-463; AD-636979; QTR-1) CFSTI: HC $3.00/MF $0.50

The system objectives of providing surveillance at teleseismic distances on a worldwide basis are presented in terms of tradeoffs to establish surveillance requirements. The operational parameters are discussed and related to the processing requirements in terms of the number of preformed beams to be generated. Function and data flow descriptions are given to establish methodology and technique, respectively. Processing equipment configuration, and operator functions and requirements are discussed relative to system design. The sensitivity of the beam requirements are assessed in relation to the assumptions made in deriving them, and filter coefficients and time delays are calculated. Specifications are listed for scaling, seismometer sensitivity tolerances, sampling rate, and quantization and worklength. Summary data are also presented on other tasks being carried out in support of the system. M.G.J.

N67-13235*# Volt Technical Corp., Washington, D. C.
OBSERVATIONS OF EXTREMELY LOW FREQUENCY EMISSION AT TWO CONJUGATE POINTS [NABLYUDENIYA UL'TRANIZKOCHASTOTNOGO IZLUCHENIYA V DVUKH SOPRYAZHENNYKH TOCHKAKH]
N. G. Kleymenova, V. A. Troitskaya, R. Zhandren, K. Ponso, and Zh. Vinaron 21 Nov. 1966 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofiz. (Moscow), v. 170, no. 4, 1966
(Contract NAS5-12487)
(NASA-CR-80578; ST-AI-GM-10540) CFSTI: HC $1.00/MF $0.50 CSCL 04A

This paper brings forth a few conclusions resulting from the combined Soviet-French investigations of extremely low frequency (elf) emissions at two magnetically conjugate points, of which the principal are that choruses, observed simultaneously at conjugate stations, are forerunners of impending negative ionospheric storms. During magnetoquiet days, no favorable conditions exist for the generation of elf in the Earth's exosphere when the outer magnetosphere boundary is situated at $10R_E$. Author

N67-13252# California Univ., Livermore. Lawrence Radiation Lab.
WASHOUT OF PARTICULATE MATTER IN LONG-TERM CLOUDS PRODUCED BY NUCLEAR EXPLOSIONS
Allen H. Petersen 14 Mar. 1966 24 p refs
(Contract W-7405-ENG-48)
(UCRL-14700) CFSTI: HC $2.00/MF $0.50

The theory of rain-scavenging of airborne particulate matter is extended to the more general case of moving, polydisperse populations. Values for a multidimensional washout coefficient as a function of particle radius and rain intensity are given. By using expressions for the concentration within an instantaneous point source cloud with a spectrum of particle sizes, formulas are derived which give the rate of deposition and integrated deposition of radioactivity or particles from a long-term nuclear device cloud at any point downwind. Two important meteorological situations which may occur during washout are analyzed separately. The general expressions show that in a long-term nuclear device cloud, both the rate of deposition and integrated deposition are functions of the following independent variables: radius of the device cloud in the direction of the wind speed; wind speed, or speed of the cloud relative to the rain-producing layer; shape of the cloud's concentration; distance downwind; and rain intensity. By employing recent empirical data for the distribution of radioactivity with particle size within the cloud from the Sedan event, the equations are used to calculate the maximum integrated deposition of radioactivity which might be scavenged from long-term clouds produced by a nuclear device used for excavation. The maximum percentage of the cloud's radioactivity deposited within the first meter is presented nomographically with various wind speeds in miles per hour and rain intensities in millimeters per hour.
Author (NSA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N67-12321# Columbia Univ., New York. Lubrication Research Lab.
AN EXPERIMENTAL STUDY OF AIR-LUBRICATED FOILS WITH REFERENCE TO TAPE TRANSPORT IN MAGNETIC RECORDING
L. Licht Aug. 1966 161 p refs
(Contract Nonr-4259(14))
(Rept.-7; AD-638010) CFSTI: HC $5.00/MF $1.00

An elastic foil under tension is wrapped partly around a rotating cylinder and is supported on a thin film of air. Capacitance probes, coincident with the surface of the cylinder, scan the air gap along the arc of wrap. The cylinder can be traversed across the width of the stationary foil, so that the topography of the air gap can be determined from a series of circumferential scans. Experimental results are compared quantitatively with theoretical predictions for the perfectly flexible and for the elastic foil-bearing of infinite width. A comparison is also made with theory, for the case when the angle of wrap is small and the entrance and exit transition zones merge. The effect of foil and gap width on side leakage is illustrated. The major part of the study deals with elastic foil-bearings of finite width and with the characteristic 'edge effect' in particular. The influence of various parameters on the nature of the displacement field of foils is demonstrated and related to recent analyses.
Author

N67-12401# Joint Publications Research Service, Washington, D. C.
IZVESTIYA VUZov: IN INSTRUMENT BUILDING, VOLUME 9, NUMBER 3, 1966
12 Oct. 1966 172 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Priborostr. (Leningrad), v. 9, no. 3, 1966 172 p
(JPRS-38133; TT-66-34560) CFSTI: $4.00

In this translation of the Russian language periodical, *News of Higher Educational Institutions*, details are given on the experimental research being conducted in developing various types of instrumentation. These include monitoring and measuring devices, micrometers, transducers, semiconductor triodes, coaxial resonators, gyroscopes, and regulators.
M.G.J.

N67-12404* Joint Publications Research Service, Washington, D. C.
ON APPLICATION OF TRANSFORMATION SPECTRUM FOR ANALYSIS OF SIGNAL FREQUENCIES
V. M. Chernitser *In its* Izv. VUZov: Inst. Bldg. 12 Oct. 1966 p 12-15 refs (See N67-12401 03-14) CFSTI: $4.00

Questions related to the transformation of the spectrum of subaudio-frequencies are examined with the aid of a magnetic recording system and the reproduction of signals. Separate and combined recording and reproduction are investigated, and results obtained in the process of developing an analyzer of the frequency spectrum of biocurrents from a brain are included.
C.T.C.

N67-12405# Joint Publications Research Service, Washington, D. C.
INDUCTIVE FREQUENCY MICROMETER
V. S. Gutnikov and E. I. Rodion *In its* Izv. VUZov: Instr. Bldg. 2 Oct. 1966 p 16-19 (See N67-12401 03-14) CFSTI: $4.00

A semiconductor frequency inductive micrometer with a practically linear transformation function is described.
Author

N67-12406# Joint Publications Research Service, Washington, D. C.
HIGH-SPEED PULSE-TIME AC TRANSUDCER
T. M. Aliyev, M. G. Grinberg, and A. A. Terkhachaturov *In its* Izv. VUZov: Instr. Bldg. 2 Oct. 1966 p 20-24 refs (See N67-12401 03-14) CFSTI: $4.00

The authors described the operating principle and the results of investigating a high-speed pulse-time transducer with an integrator. This is based on a magnetic core with a rectangular hysteresis loop for a discrete telemetering system of two continually varying functionally related values.
Author

N67-12407# Joint Publications Research Service, Washington, D. C.
ON ERRORS OF MULTIELEMENT AUTOMATIC DEVICES WITH LINEAR DIAL
Sh. Yu. Ismailov and A. M. Smolyarov *In its* Izv. VUZov: Instr. Bldg. 2 Oct. 1966 p 25-30 refs (See N67-12401 03-14) CFSTI: $4.00

One of the possible methods of determining the maximal errors of multi-element automatic devices with a linear dial is reviewed.
Author

N67-12418# Joint Publications Research Service, Washington, D. C.
ON THE POSSIBILITY OF USING A VERTICAL GYROSCOPE IN ITS STARTING CONDITION
M. A. Pavlovskiy *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 77-83 refs (See N67-12401 03-14) CFSTI: $4.00)

It is shown that by the introduction of a delay in a device's actuation in relation to the time of its being started, there is created the possibility of using a vertical gyroscope in its starting regime. A vertical gyroscope on a stationary base is reviewed. Author

N67-12419# Joint Publications Research Service, Washington, D. C.

ON THE PROBLEM OF INCREASING THE ACCURACY OF GYROSCOPES

O. G. Alekseyev, V. P. Demidenko, and I. M. Fedorov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 84–87 ref (See N67-12401 03-14) CFSTI: $4.00

One of the possible methods of increasing the accuracy of gyroscopic devices by increasing the kinetic moment with the application of multi-rotor gyromotors is reviewed. Author

N67-12420# Joint Publications Research Service, Washington, D. C.

CHOICE OF GYROROTOR FOR PROVIDING THE MINIMUM AERODYNAMIC RESISTANCE

M. P. Shumskiy and Ye. Ye. Ivanov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 88–91 refs (See N67-12401 03-14) CFSTI: $4.00

The authors review the question of finding a form of standard rotor, providing a minimal aerodynamic resistance under the stipulations that the inertial moment of the rotor retains a given constant value, and without occurrence of this condition. Author

N67-12421# Joint Publication Research Service, Washington, D. C.

METHOD OF APPROXIMATE CALCULATION OF AERODYNAMIC GYROMOTOR LOSSES

A. G. Bessonov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 92–98 refs (See N67-12401 03-14) CFSTI: $4.00

On the basis of formulas for resistance factors of cylindrical and disk surfaces, using the additivity principle, the author finds the aerodynamic resistance of a cylindrical rotor, being further refined by a consideration of the differences in an actual rotor as compared with a cylinder. Author

N67-12422# Joint Publications Research Service, Washington, D. C.

FLOATING VIBRATORY GYROSCOPE

V. I. Kopytov and A. I. Studenikin *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 99–102 refs (See N67-12401 03-14) CFSTI: $4.00

The operating principles of a vibratory floating type of gyroscope are presented. Included is an analytical description of the motion of the float with the aid of a second order differential equation with variable coefficients. C.T.C.

N67-12423# Joint Publications Research Service, Washington, D. C.

DISTRIBUTION OF ERROR OF DISCRETE MEASUREMENT OF VELOCITIES

V. A. Levidov and O. N. Tikhonov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 99–102 refs (See N67-12401 03-14) CFSTI: $4.00

The authors suggest an estimation of the distribution of probabilities of error in the discrete measurement of velocities, and also of the range of discreteness from the condition of minimum of mean square error. Author

N67-12424# Joint Publications Research Service, Washington, D. C.

ON THE DESIGN OF INSTRUMENTED REGULATORS OF CONSTANT SPEED WITH FLUID FRICTION

G. T. Shapoval *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 106–111 refs (See N67-12401 03-14) CFSTI: $4.00

A method for calculating the braking force acting upon the piston of a regulator under laminar conditions is presented. The method takes into account the additional force being evoked by the resistance of the input and output sectors of a circular space. Experimental data are presented. Author

N67-12426# Joint Publications Research Service, Washington, D. C.

ELECTRODYNAMIC CAMERA SHUTTER

V. G. Novikov and N. F. Diyakov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 118–120 ref (See N67-12401 03-14) CFSTI: $4.00

The principle of operation and design of an electrodynamic shutter and result are given from tests typifying the quality of the shutter's work and its temporal parameters. Author

N67-12427# Joint Publications Research Service, Washington, D. C.

CORRECTION OF HOT WIRE ANEMOMETER FREQUENCY DISTORTIONS

Yu. F. Anan'yev *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 121–127 refs (See N67-12401 03-14) CFSTI: $4.00

The methods are reviewed of correcting the correlation functions of turbulent velocity pulsations of an air flow for cases when the amplifier of the pulsations of a DC thermoanemometer does not assure the precise compensation o the thermal lag of the pickup filament. The experimental results are given. Author

N67-12428# Joint Publications Research Service, Washington, D. C.

DEVICES FOR INVESTIGATING HEAT CONDUCTIVITY AND TEMPERATURE CONDUCTIVITY WITHIN THE CONTINUAL HEATING RANGE

V. V. Kurepin and Ye. S. Platunov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 128–131 refs (See N67-12401 03-14) CFSTI: $4.00

The authors review the principle of operation and the arrangement of devices for measuring the temperature dependence of λ°-conductivity and of the heat capacity of solid materials with the heat conductivity 0.1–10 w/m. degrees in the temperature range (−100 to 400)°C. Author

N67-12429# Joint Publications Research Service, Washington, D. C.

EFFECT OF NONUNIFORM RIGIDITY OF COMPONENT MATERIAL ON MACHINING PRECISION IN INSTRUMENTATION

F. P. Duzhenkov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 132–137 (See N67-12401 03-14) CFSTI: $4.00

The article covers the questions of the effect of dimensional wear of boring cutting tools on machining accuracy on fine-cutting lathes in instrumentation. Results of the experiments are given and recommendations are made. Author

N67-12430# Joint Publications Research Service, Washington, D. C.

DEVICE FOR PLOTTING PERSPECTIVE OF POINTS ACCORDING TO THEIR COORDINATES IN SPACE

G. M. Kolmakova *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 138–141 (See N67-12401 03-14) CFSTI: $4.00

A device is suggested that affords the possibility of quickly, accurately and conveniently finding the position of a point in a perspective $A_p(x_p, z_p)$ based on its coordinates A(x,y,z) in space. Author

N67-12486# Chicago Univ., Ill. Cloud Physics Lab.
AN AIRBORNE CONTINUOUS CLOUD PARTICLE REPLICATOR
Paul Spyers-Duran *In its* Rain Phys. Res., Apr. 1965–Apr. 1966 Aug. 1966 p 66–76 refs (See N67-12481 03-20)

Details are given on the development and operation of a cloud particle replicator for measuring the form, size, and frequency distributions of hydrometeors in clouds. The replicator and its accessories are shown; these consist of a film transport mechanism, a modified movie projector adapted so that the film moves at a uniform speed varying from 50 mm/sec to 250 mm/sec, a timer device, and an infusion pump for the chloroform solvent. It is reported: (1) Operation is possible in clouds with water contents from 0.1 gm/m^3 to 3 or 4 gm/m^3 and temperatures between 20° and −20°C. (2) The most reliable operation occurs in clouds of either all ice or all liquid. (3) Small cloud drops are replicated but large drops, of a size comparable with the thickness of the film, seem to be flattened in the drying process. N.A.S.

N67-12618# India. Dept. of Atomic Energy, Bombay.
ON SMALL SIGNAL NON-LINEARITIES IN FIXED PROGRAMME PROCESSORS
P. K. Patwardhan, M. G. Phadnis, C. G. Chatur, and G. S. Talgeri *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 351–355 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The pedestal technique was adapted to improve precision and zero intercept in calibration plots for large-signal vacuum tube logic. A graphical analysis is made of the pedestal logic, non-linearity, and relative non-linearity. Circuits for the analog addition and the white cathode follower type blocking gate are discussed. The technique has been successfully applied in a standard 100-channel pulse height analyzer. It was found that the simple circuits did not increase the complexity of the system. K.W.

N67-12619# India. Dept. of Atomic Energy, Bombay.
POLARISED NEUTRON SPECTROMETER
C. S. Somanathan, N. S. Satya Murthy, R. J. Begum, B. S. Srinivasan, and M. R. L. N. Murthy *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 366–370 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The use of polarized neutron beams for improving the accuracy of high angle magnetic reflection measurements is discussed. A spectrometer for such measurements is described; it is in essence a double crystal neutron spectrometer with such additional devices as a polarizing magnet, a guide field, a spin-flipper, and an electromagnet. The polarized neutrons are obtained by Bragg scattering from the (111) planes of magnetized Co_{92} Fe_8 crystal, placed in transmission orientation. With a reactor operating at the full power of 40 MW, the flux of polarized neutrons falling on the sample was estimated to be of the order 5×10^6 neutrons/cm^2/sec. Polarizing efficiencies as high as 98.5% were obtained. Over-all performance of the spectrometer was assessed in a form factor variation study of the magnetic scattering of nickel. The results are found to be in agreement with data obtained by other authors. K.W.

N67-12620# India. Dept. of Atomic Energy, Bombay.
AN ABSOLUTE POSITION DIGITAL INDICATOR FOR A NEUTRON DIFFRACTOMETER
P. K. Patwardhan, P. R. Chetty, and V. M. Misra *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 371 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The indicator was developed for use with a three-dimensional fully automatic neutron diffractometer to be used in solid state studies. A brief description of the instrument is given. The complete instrumentation employs solid state logic. Other special features are: (1) readout on in-line nixie indicators; (2) bi-directional operation for addition and subtraction; and (3) pre-setting arrangement with uni-selectors. Performance in field tests proved satisfactory. K.W.

N67-12621# Saha Inst. of Nuclear Physics, Calcutta (India).
PULSE PROBE MEASUREMENTS OF GAS DISCHARGE PLASMAS
D. K. Bose, N. K. Majumdar, B. D. Nagchaudhuri, S. N. Sengupta, and S. K. Majumdar *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 372–375 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Developed were a pulsed method for measuring the usual plasma parameters and a technique for simultaneous extraction of electrons and ions from duoplasmatron. In the pulsed method, triangular pulses are applied to the negatively biased probe. The resulting current–voltage characteristics are recorded with an oscilloscope. Used as probe was a piece of tungsten wire. Probe data showing the effects of magnetic field and arc current are presented. In the simultaneous extraction method, a plasma expansion chamber with two exit holes, each having an extractor, is placed after the anode orifice. An extraction voltage of 2 kV was applied. It was observed that the Faraday cage current for ions increased by 50 to 100% with the simultaneous extraction of electrons and ions. This double extraction technique is thought to be useful in the working of ion engines for electrostatic propulsion. K.W.

N67-12622# Saha Inst. of Nuclear Physics, Calcutta (India).
RF STUDY OF PENNING PLASMA
J. Basu, C. Dutta, and S. N. Sengupta *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 376–380 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The study was conducted within a frequency range of 0.5 to 30 Mc/sec. A pyrex glass Penning discharge tube with two aluminum cathode plates and two copper ring anodes was used in the experiments. The discharge was maintained in air at a pressure of about 10^{-3} mm Hg. The discharge current was 20 mA, the magnetic field strength was approximately 800 G. A nickel disc probe supported by a tungsten rod was used. Experiments were conducted with an rf voltage of 10 V and then repeated for an rf voltage of 5 V. Among the special features of the Penning plasma that were noted was that both the electron and ion currents were somewhat oscillatory in nature as the frequency was varied. The electron current turned out to be less than its static value in certain frequency ranges. K.W.

N67-12639# Weapons Research Establishment, Salisbury (Australia).
THE MEASUREMENT OF THE FOCAL LENGTH OF LONG FOCAL LENGTH LENSES
R. E. Little Jul. 1966 12 p ref
(WRE-TN-ISD-75)

A simple instrument was built which produces a number of parallel beams of light which diverge from one another at known precise angles. These beams all originate from a single slit source and a series of slit images is obtained when they are focussed by a lens. The focal length of the lens can be determined

by measuring the separation of these images. The accuracy of the focal length measurement depends on the accuracy to which the angle between the beams is known and the accuracy to which the separation of the images can be measured. It was found with the existing prototype instrument that the focal length of a nominally 80 inch lens could be measured to an accuracy of ±0.15 inches. R.N.A.

N67-12687# Royal Aircraft Establishment, Farnborough (England).
THE INVESTIGATION OF A PRINCIPLE APPLICABLE TO A HIGH SENSITIVITY ACCELEROMETER [RECHERCHE SUR UN PRINCIPE D'ACCELEROMETRE DE GRANDE SENSIBILITE]
Michel Gay Jul. 1966 15 p refs Transl. into ENGLISH from Rech. Aerospatiale (France), no. 110, Jan./Feb. 1966 p 39–44
(RAE-LIB-TRANS-1174) CFSTI: HC $1.00/MF $0.50

An investigation is being conducted on the problem of highly sensitive accelerometers. After some general considerations of the particular features of this type of instrument, experimental results from a model in the 10^{-5}g to 10^{-6}g measuring range are given. A second model, in the 10^{-4}g to 10^{-7}g range which is in the process of production is described. The results so far obtained make it possible to contemplate thresholds of measurement of the order of 10^{-9}g. Author

N67-12689# Aktiebolaget Atomenergi, Stockholm (Sweden).
OPTIMAL LINEAR FILTERS. 2: PULSE TIME MEASUREMENTS IN THE PRESENCE OF NOISE
K. Nygaard Sep. 1966 10 p ref
(AE-249) CFSTI: HC $1.00/MF $0.50

The problem of calculating the maximum available timing information contained in nuclear pulses in the presence of noise is solved theoretically. Practical experiments show that the theoretical values can be obtained by very simple, but untraditional, means. An output pulse from a practical filter connected to a charge sensitive amplifier with a Ge(li) detector showed a rise time of 30 ns and a noise level of less than 5 keV. The time jitter measured was inversely proportional to the pulse height and less than 30 ns for 10 keV pulses. With the timing filter shown solid state detectors can be classified somewhere between NaI scintillators and organic scintillators with respect to time resolution. Author

N67-12761 Joint Publications Research Service, Washington, D. C.
IZVESTIYA VUZOV: INSTRUMENT BUILDING, VOL. IX, NO. 4, 1966
22 Nov. 1966 185 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), v. 9, no. 4, 1966 p 3–141
(JPRS-38750; TT-66-35174) CFSTI: $5.00

Journal papers on radio electronic instruments, precision mechanics devices, and gyroscopic, navigation, computing, optical, and thermal instruments are presented. For individual titles see N67-12762–N67-12792.

N67-12767 Joint Publications Research Service, Washington, D. C.
CONCERNING THE THEORY OF FREQUENCY-METER ERRORS
Yu. F. Shcherbakov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 21–26 ref (See N67-12761 03-14) CFSTI: $5.00

The physical nature of errors obtained by measuring the frequency with the aid of electronic counters is considered. An analytical expression is given for the probable distribution of errors and expressions for estimating the random, systematic, and permanent errors. Author

N67-12768 Joint Publications Research Service, Washington, D. C.
GALVANOMETER-TYPE TORQUE COMPENSATOR WITH DIGITAL OUTPUT
V. V. Savin and F. M. Nagiyeva *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 27–31 refs (See N67-12761 03-14) CFSTI: $5.00

A description is given of a galvanometric torque compensator with a digital output. The torque measured by the instrument is compensated by the torque of the galvanometric compensator, which increases linearly. When this occurs, the torque is transformed during the intervals of time at which the electrical pulses enter the counter; the number of pulses is proportional to the measured parameter. Author

N67-12769 Joint Publications Research Service, Washington, D. C.
CAPACITANCE TRANSDUCERS WITH CROSS-BENT PLATES
A. P. Gritsenko, I. N. Magda, and N. S. Lozhak *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 32–37 refs (See N67-12761 03-14) CFSTI: $5.00

Results are given of an analytical and experimental study of capacitative pickups in which the measured nonelectrical values cause cross-bonds in the plates and change the capacitance of the transducer. Experimentally checked expressions are given for the deformation relationships in certain types of transducers. It is shown that such pickups can be employed for accurate recording of displacements, forces, and other mechanical values. Author

N67-12775 Joint Publications Research Service, Washington, D. C.
AUTOMATION OF PROCESSING OF OSCILLOGRAMS OBTAINED IN TESTING OF VESSELS
K. G. Krol', A. A. Smirnov, and S. A. Smirnov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 62–67 refs (See N67-12761 03-14) CFSTI: $5.00

This article describes a device for automating the processing of oscillograms obtained by testing vessels under natural conditions. By shifting the tape with its oscillogram, the recurrence of each combination of half-period and amplitude is recorded by counters whose readings are used for plotting curves of security for the investigated parameter. Author

N67-12777 Joint Publications Research Service, Washington, D. C.
AERODYNAMIC RESISTANCE TORQUE OF GYROMOTORS OPERATING IN HYDROGEN AND HELIUM
B. A. Delektorskiy and I. N. Orlov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 71–74 refs (See N67-12761 03-14) CFSTI: $5.00

The aerodynamic resistance torque of gyromotors operating in hydrogen and helium is computed by using expressions obtained as a result of experimental investigations. Author

N67-12778# Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF GYROSCOPE RESTING ON SPHERICAL BEARING
O. A. Ivanov and V. L. Rapoport *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 75–79 refs (See N67-12761 03-14) CFSTI: $5.00

Under consideration is a high speed gyroscope resting with a cone-shaped cup on a stationary ball. Expressions are derived for the moments of forces applied by the ball on the gyroscope. Author

N67-12780# Joint Publications Research Service, Washington, D. C.

EFFECT OF VISCOUS FRICTION ON THE PRECESSIONAL MOTION OF GYROSCOPE REQUIRING CORRECTION

Pavlov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, no. 4 22 [illegible]. 1966 p 87–90 *ref* (See N67-12761 03-14) CFSTI: $5.00

It is shown that at different relationships between the parameters of a corrected astatic gyro and the moments of the forces of viscous friction, the pole of the gyro arrives at a position of equilibrium by different curves, including an exponential function and logarithmic spiral. Author

N67-12781# Joint Publications Research Service, Washington, D. C.

DESIGN FEATURES OF VIBRATING PLATE GAGES FOR MEASURING PULSING FORCES

A. V. Ivanov and V. I. Sergeyev *In its* Izv. VUZov: Instr. Bldg., Vol. IX, no. 4 22 Nov. 1966 p 91–97 refs (See N67-12761 03-14) CFSTI: $5.00

The problems connected with the calculation of vibrating plate force-measuring pickups designed for measuring the average values of nonstationary forces are considered. Expressions derived are for the maximum allowable changes in the frequency of the pickups acted on by the measured forces and the minimum time for carrying out the measurements. Recommendations are given for selecting the relationships between the plate-dimensions of differential pickups. Author

N67-12782# Joint Publications Research Service, Washington, D. C.

MEASURING RESIDUAL STRESSES BY USING VIBRATIONS TO REDUCE FRICTION

I. P. Moiseyev *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 98–100 refs (See N67-12761 03-14) CFSTI: $5.00

A unit is described for measuring the residual stresses by using the method of etching and vibrations to reduce the effect of friction in the moving joints. Author

N67-12783# Joint Publications Research Service, Washington, D. C.

HIGH-PRECISION MEASUREMENT OF THE RPM OF ELECTRIC MOTORS

V. V. Andrushchuk, Yu. N. Yegorov, and V. V. Shestatskiy *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 101–103 (See N67-12761 03-14) CFSTI: $5.00

Two methods of measuring with a high degree of accuracy the rpm of electric motors by using high speed computing circuits are considered. The errors of the measurements are evaluated and the results of an experiment are given. Author

N67-12787# Joint Publications Research Service, Washington, D. C.

MEASUREMENT OF SMALL PERIODIC DISPLACEMENTS WITH THE AID OF AN INTERFEROMETER

V. N. Rudenko *In its* Izv. VUZov: Instr. Bldg., Vol. IX, no. 4 22 Nov. 1966 p 120–124 refs (See N67-12761 03-14) CFSTI: $5.00

A unit is described that is based on an interferometer. The instrument can determine with a probability of 0.95 periodic displacements of about 10 cm by spending about 10 min on the measurements. Author

N67-12789# Joint Publications Research Service, Washington, D. C.

THE LOAD CHARACTERISTICS OF MINIATURE THERMOTRANSDUCERS

Ye. I. Fandeyev and A. V. Markson *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 131–134 refs (See N67-12761 03-14) CFSTI: $5.00

A method is described for investigating errors caused by the heat of the measuring currents of miniature resistance thermometers. Results are given of the study of overheated miniature wire-thermoreceivers. Author

N67-12790# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE TEMPERATURE EFFECT ON THE ACCURACY OF MEASURING MACHINES UNDER UNSTABLE TEMPERATURE CONDITIONS

A. D. Rubinov *In its* Izv. VUZov: Instr. Bldg., Vol. IX, no. 4 22 Nov. 1966 p 135–138 (See N67-12761 03-14) CFSTI: $5.00

Results are given of observations made in a laboratory of air temperatures, a measuring machine, and the inside caliper installed on the machine. Results of observing the changes in the inside caliper are also given. It was concluded that it is not possible to perform the measurement at temperatures equal to 20°C, or to adjust the temperatures, and that errors are inavoidable due to the instability of the temperature. Author

N67-12807# Joint Publications Research Service, Washington, D. C.

A NEW TYPE OF THERMOBALANCOGRAPH AND RESULTS OF ITS TESTS UNDER FIELD CONDITIONS

N. A. Yefimova and M. G. Sanoyan *In its* Meteorol. and Hydrol., No. 9, 1966 23 Nov. 1966 p 44–51 refs (See N67-12801 03-20) CFSTI: $3.00

The addition of an on-line computer and a semiconductor in the thermobalancograph, and the resulting field test data are described. The most important distinguishing characteristic of the improved equipment is considered to be the simultaneous feeding of electrical signals produced by sensors to a computer of the continuous-action type. The apparatus was tested in a field of winter wheat, and the data on air temperature and humidity gradients, radiation balance, and heat flux are presented and discussed. It was concluded that the instrument with the automatic recording of the heat balance components gives more representative characteristics than the standard apparatus. N.E.N.

N67-12841# International Training Centre for Aerial Survey, Delft (Netherlands).

AN APPROACH TO CLASSIFICATION OF STEREO RESTITUTION SYSTEMS

B. Makarovic 1966 15 p refs *Its* Ser. A, No. 36 CFSTI: HC $1.00/MF $0.50

A classification system is proposed for the photogrammetric stereo restitution systems. For this purpose three basic criteria are used: the application regarding input and output, the internal structure arranged according to the flows of semantic and metric information, and the quality and economy of restitution. The proposed system can be arbitrarily extended or simplified if so desired. The principle might be valuable for education, commerce and analysis of stereo restitution systems. Author

N67-12842# International Training Centre for Aerial Survey, Delft (Netherlands).

PRACTICAL APPLICATIONS OF AERIAL PHOTOGRAPHS IN FORESTRY AND OTHER VEGETATION STUDIES, SERIES B, NO. 36

D. A. Stellingwerf 1966 60 p refs In ENGLISH; FRENCH; and SPANISH

CFSTI: HC $3.00/MF $0.75

Tropical and subtropical vegetation types are described by means of interpreted stereograms and photomosaics, and the advantages and limitations of aerial photographs in forestry and vegetation interpretation are assessed. The problems involved in species recognition are discussed from the viewpoint of focal lengths, scales, film–filter combinations, and film sensitivity. The relative merits of panchromatic, infrared, and spectrozonal films are considered, with spectrozonal film recommended for use in interpreting vegetation variations. The time and money saving features of aerial photography in forestry are cited; however, the point is made that the forester must be familiar with vegetation in an area before he can deduce relevant facts from the photographs.
M.G.J.

N67-12849# International Training Centre for Aerial Survey, Delft (Netherlands).

PARALLAX SENSING IN STEREO MEASUREMENTS

B. Makarovic 1966 19 p refs *Itz* Ser. A, no. 37

CFSTI: HC $1.00/MF $0.50

Stereoscopic measurements are affected, apart from the metric and physical disturbances, by another fundamental phenomenon–the dependency of parallax sensing on density patterns. The disturbing effect of this phenomenon may essentially exceed errors originating in other sources. In this context the concepts of binocular image registration, stereoscopic power and parallax sensing and elimination are specified. Further, factors affecting the stereoscopic power are treated. Density patterns may be specified with three parameters: the degree of randomness, quantity of detail and the contrast. Some experiments performed on selected density patterns confirmed the significance of the above mentioned phenomenon. Corresponding results are illustrated. The conclusions are summarized in practical recommendations.
Author

N67-12850# International Training Centre for Aerial Survey, Delft (Netherlands).

PRACTICAL APPLICATIONS OF AERIAL PHOTOGRAPHS IN FORESTRY AND OTHER VEGETATION STUDIES, SERIES B, No. 37

D. A. Stellingwerf 1966 36 p refs In ENGLISH; FRENCH; and SPANISH

CFSTI: HC $2.00/MF $0.50

Several stereograms of fresh water swamp forest are presented, and an interpretation of each is given. These include the forest structure along a meandering river and flood plain in a coastal region; an area covered with a swamp forest; fresh water swamp forest adjacent to mangrove vegetation, with an ecotonic zone between the two types; peat swamps; and a swamp forest behind a sandy coast with a dry land forest occurring further inland. The recognition of commercially important species is also discussed.
M.G.J.

N67-12851# International Training Centre for Aerial Survey, Delft (Netherlands).

PRACTICAL APPLICATIONS OF AERIAL PHOTOGRAPHS IN FORESTRY AND OTHER VEGETATION STUDIES, SERIES B, NO. 38

D. A. Stellingwerf 1966 45 p refs In ENGLISH; FRENCH; and SPANISH

CFSTI: HC $2.00/MF $0.50

The factors influencing the growth of mangrove forests are reviewed, and the geographical distribution of the various species is discussed. The species are grouped according to those growing on land flooded by the (1) lower limit of normal high tides; (2) medium high tides; (3) upper limit of normal high tides; (4) spring tides only; and (5) equinoctial or other exceptional tides. Several stereograms pertaining to the various species are presented, and the difference between the vegetation types are interpreted.
M.G.J.

N67-12869# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

ADVANCED ALPHA–BETA–GAMMA HAND AND SHOE CONTAMINATION MONITOR

E. M. Shean, C. A. Ratcliffe, and L. V. Zuerner Aug. 1966 25 p refs

(Contract AT(45-1)-1830)

(BNWL-250) CFSTI: HC $1.00/MF $0.50

A combination alpha–beta–gamma hand and shoe contamination monitor was developed which incorporates low-noise multiplier phototubes, special light pipes, probe-contained preamplifiers to provide a satisfactory signal-to-noise ratio, and all solid state circuitry with no relays. The main chassis contains power supplies, indicating registers, all circuitry except that used in the probes, and adjustment controls that are incorporated in a printed circuit card file. Solid state circuits were developed and fabricated on printed circuit cards that were size-compatible with available, commercial card files. These circuits, combined with commercially available logic units, provided an instrument that reduced both capital and maintenance costs. The basic design is that of a combination alpha–beta–gamma contamination monitor; however, the general design features are directly applicable to the manufacture of single-purpose instruments, as for beta–gamma only or for alpha–only monitors.
Author (NSA)

N67-12897# Royal Aircraft Establishment, Farnborough (England).

RECENT DEVELOPMENTS IN SATELLITE OBSERVATION TECHNIQUES [REALISATIONS RECENTES DANS LES TECHNIQUES D'OBSERVATION OPTIQUE DES SATELLITES]

P. Muller Aug. 1966 9 p refs Transl. into ENGLISH from COSPAR Inform. Bull. (The Hague), no. 30, Feb. 1966 p 15–20

(RAE-LIB-TRANS-1178) CFSTI: HC $1.00/MF $0.50

Astro II, a theodolite specially built for the tracking of satellites and an automatic star identification technique are described.
Author

N67-12898# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Physics Div.

RECENT WORK WITH Ge(Li) γ-RAY SPECTROMETERS AT CHALK RIVER

G. T. Ewan, H. L. Malm, and I. L. Fowler Jul. 1966 59 p refs Presented at the IAEA Panel Meeting on use of Germanium–Lithium-drift γ-ray Detectors for Res. in Nucl. Phys., Vienna, 6–10 Jun. 1966

(AECL-2607) CFSTI: HC $3.00/MF $0.75

A review is given of some recent work with Ge(Li) detectors. The development and properties of large volume coaxial detectors are discussed briefly and typical results of measurements of the resolution, efficiency, and peak-to-total ratios for these detectors are presented. Results of performance tests on encapsulated detectors are summarized. Some of the factors affecting the pulse shape from Ge(Li) detectors are considered and time distribution measurements from coaxial detectors are shown. These detectors are being used in a Ge(Li)–Ge(Li) γ–γ coincidence arrangement and typical results are given. The use of the detectors in the

experimental program include experiments on nuclear decay schemes, γ-rays from nuclear reactions, neutron capture γ-rays, resonance γ-ray scattering, muonic X-rays, and experiments associated with nuclear reactor development. Author

N67-12935*# California Univ., Los Angeles. Inst. of Geophysics and Planetary
A PHOTOELECTRIC SKYLIGHT POLARIMETER Scientific Report No. 1
T. A. Hariharan Sep. 1966 44 p refs
(Grant NGR-05-007-041)
(NASA-CR-80192; SR-1) CFSTI: HC $2.00/MF $0.50 CSCL 20F

A photoelectric skylight polarimeter to measure directly the Stokes parameters for plane polarized light is described. The basic principle of the instrument consists in the simultaneous measurement of the intensity of light (in the chosen spectral region) transmitted by polarizers oriented in four specific directions. The main features and performance characteristics of the instrument and associated equipment are discussed in detail. Author

N67-12962*# Research Triangle Inst., Durham, N. C. Solid State Lab.
FEASIBILITY STUDY OF PIEZOTRANSISTOR ACCELEROMETERS Annual Report, Sep. 1965–Oct. 1966
Oct. 1966 151 p refs
(Contract NASr-222)
(NASA-CR-80346; AR-2) CFSTI: HC $5.00/MF $1.00 CSCL 14B

Utilization of the piezojunction effect as the sensory phenomenon in accelerometers and other transducers is considered. Application of the phenomenon and development of the silicon needle sensor were of primary concern. Discussed are needle fabrication, junction formation, stress and displacement of needles under applied force, and electrical response of silicon needle diodes under stress. Accelerometers of the single-diaphragm, double-diaphragm, and beam types were designed, fabricated, and tested. The use of the basic silicon needle as a direct coupled force and displacement transducer, as a cantilever transducer, and as pressure sensor is covered. Read-out circuitry is discussed, including differential amplifiers, four-layer switch oscillators, and unijunction oscillators. The stress effects on p-n–p-n diodes was investigated. Stress induced changes in the breakdown voltage of Ge and Si p-n junctions are discussed, and a theoretical model is developed for the effects of stress on generation–recombination currents in p-n junctions. K.W.

N67-12965*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMOMETRY PROJECT Final Report
L. L. Sparks and R. L. Powell 30 Jun. 1966 137 p
(NASA Order H-92152; NBS Proj. 31503-12-3150532)
(NASA-CR-80343; NBS-9249) CFSTI: HC $4.00/MF $1.00 CSCL 20 M

Commercially available low temperature thermocouple wire from all major manufacturers has been exhaustively tested to determine the inhomogeneity and interchangeability characteristics of the wire. The results of special tests to determine the effect of straining or kinking thermocouple wire are also given. Previously printed low temperature thermocouple tables have been smoothed in the first and second differences and are included as an appendix to the report. Spot calibrations between liquid helium and liquid nitrogen temperatures and between liquid nitrogen and ice temperatures show that these tables are sufficient for most engineering requirements. Preliminary work on several gold–iron alloys indicates that these alloys will allow more accurate thermoelectric temperature measurement in the liquid helium–liquid hydrogen temperature range. Author

N67-12967*# Electro-Optical Systems, Inc., Pasadena, Calif.
SOLAR REFLECTING BEACON Monthly Report, 17 Sep.–18 Oct. 1966
B. E. Kalensher and D. E. Stewart 28 Oct. 1966 63 p refs
(Contract NAS9-4790)
(NASA-CR-80341; EOS-6976-ML-4; MR-4) CFSTI: HC $3.00/MF $0.75 CSCL 17H

Over-all purpose of the study is to develop conceptual and engineering designs for two types of lunar solar reflecting beacons emplaced during the early Apollo Lunar Landing Missions. Covered in this report are: (1) equations, programs, and computer data related to the orientation analysis; (2) calculations for terrestrial and cislunar beacon sizes as a function of visual and photographic observation; (3) investigation of various beacon concepts; (4) analysis of orientation concepts; and (5) discussion of the use of a sun pumped laser as a beacon for transmitting lunar experimental data. Minimum beacon sizes are recommended for various range and detector cases. K.W.

N67-12992*# Adcom, Inc., Cambridge, Mass.
SYSTEM FOR THE MEASUREMENT OF OSCILLATOR INSTABILITY
Ahmad F. Ghais, Richard N. Lincoln, Southard Lippincott, Peter A. Olendzenski, and Richard W. Porter 31 Oct. 1966 70 p
(Contract NAS8-11228)
(NASA-CR-80364) CFSTI: HC $3.00/MF $0.75 CSCL 14B

Results of a study and laboratory development effort focusing on the design, testing, and evaluation of a breadboard model of a new technique for measuring the frequency instability of high precision oscillators as a hydrogen maser are reported. The primary objective of this study was to demonstrate the feasibility of a coherent detection measurement technique which suitably expresses the spectral characteristics of a CW signal in a manner that characterizes the frequency instability of an oscillator in a useful way by measuring the power density spectrum of the frequency or phase fluctuations of the oscillator output signal. Documented are results of efforts leading to the development of automatic detection loop circuits, predetection error multiplication circuits, and the solution of system interface problems. Included are data on system performance, results of spectral measurements which demonstrated system sensitivity and accurateness, and suggested improvements for inclusion in an advanced successor to the measurement system. It is recommended that this system be used in the evaluation of maser, crystal, cesium-beam, and other oscillators, and to aid in the development of low-noise synthesizers. S.C.W.

N67-13070# Michigan Univ., Ann Arbor. Electro-Optical Sciences Lab.
ELECTRO-OPTICAL IMAGE SYNTHESIS AND COMMUNICATIONS BY HOLOGRAPHIC (WAVEFRONT-RECONSTRUCTION) METHODS
George W. Stroke *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 179–202 refs Sponsored in part by NASA, NSF, and ONR (See N67-13061 03-23) CFSTI: HC $5.21/MF $2.00

Three new areas of holography (wavefront-reconstruction imaging and applications) are presented. Fourier-transform holography has permitted very considerable mathematical and experimental simplicity to be introduced into the field of wavefront-reconstruction imaging. In addition to this formalism and examples of three-dimensional imaging, two new applications are particularly signed out: Fourier-transform holography with extended

sources and holography with double-exposed (or multiple-exposed) holograms, both of which permit image "coding" and "decoding", the latter by successively adding intensities in a single hologram. Author

N67-13071# Compagnie Generale de Telegraphie sans Fil, Paris (France). Department de Physique Appliquee.
LINEARITY OF OPTICAL TRANSFORMATIONS UNDER COHERENT ILLUMINATION [LINEARITE DES TRANSFORMATIONS OPTIQUES EN ECLAIRAGE COHERENT]
Serge Lowenthal *In* Agard Optoelectron. Components and Devices Sep. 1965 p 203–212 refs In FRENCH; ENGLISH summary (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

Under coherent illumination an optical instrument always gives a linear object-image correspondence in complex amplitude; however, it is generally not invariant with translation, which may strongly affect its response. The conditions for achieving invariance with translation under coherent illumination, over a wide field, are determined and it is shown that these conditions are a prerequisite for optical data processing. Author

N67-13074# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
MOSAIC ELECTRO-OPTICAL TECHNIQUES
Gene Strull *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 251–273 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00
(Contract AF 33(616)-8449)

Recent advances in solid state sensors, solid state light sources and functional electronic blocks, particularly in the linear area, have made possible new and unique electro-optical systems. The impact is most strongly felt in the area of the mosaic system. Advanced mosaic sensors, systems for properly reading out these sensors and electro-optical schemes utilizing solid state sources and receivers in new configurations have been developed. Three levels of systems are considered: the integrated conventional radiation sensor in mosaic form; the molecularized sensor, including its output circuitry, as an all electrical readout system for sensing radiation; and, finally, the mosaic system employing electro-optical techniques in the readout circuitry. Specific examples of the performance of these are described, the theoretical considerations outlined, the important parameters given; the relationship between parts considered and examples of the working performance of systems which have been constructed utilizing all three techniques are described. Author

N67-13079# Raytheon Co., Bedford, Mass. Missile Systems Div.
OPTOELECTRONIC AIRCRAFT ALTIMETER
James E. Hopson *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 329–343 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

The basic optoelectronic components, consisting of an electron injection laser diode, an optical transmission medium, and a silicon photodetector, have been adapted to the purpose of determining aircraft height during landing. The height determination is made on the basis of the transit time required for a light beam to travel from the laser to the ground and back to the photodetector. Two modes of operation are considered. In the first case a cryogenically cooled injection laser is sine-wave modulated in a continuous manner. The transit time of the light beam may be measured in terms of a shift in the modulation phase between the outgoing and incoming light waves. In the second case an injection laser is pulse modulated at room temperature with a fast rise optical output. A direct measure of the transit time of the light pulse enables a height measurement. In connection with these modes of operation, the latest advances in electron injection lasers and photodiodes will be discussed. The advantages and disadvantages of the optoelectronic technique relative to other techniques are also discussed. Author

N67-13124*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
SMALL CURRENT MEASUREMENTS WITH INSULATED GATE FIELD EFFECT TRANSISTOR ELECTROMETERS
W. T. Homiller 15 Nov. 1966 52 p refs
(Grant NsG-134)
(NASA-CR-80490; SR-284(E)) CFSTI: HC $2.50/MF $0.50 CSCL 14B

An analysis of a dc feedback is presented. The circuit uses an insulated gate field-effect transistor input as a solution to the limitations associated with the electrometer vacuum tubes which are presently used. The factors which affect frequency response, open loop voltage gain, and temperature dependence are determined, and methods are found for increasing response speed and for minimizing drift. Based on the above, a practical circuit is designed and evaluated experimentally. Author

N67-13151# European Atomic Energy Community, Ispra Chemistry Dept.
ELECTRONIC INSTRUMENTS FOR RADIATION DETECTORS AND CONTROL SYSTEMS
R. Benoit, E. De Blust, L. Isabella (CEI, Milan), V. Mandl, and G. Melandrone Brussels, EURATOM, Aug. 1966 37 p refs
(EUR-3063.e) CFSTI: HC $2.00/MF $0.50

Electronics instruments developed in the Nuclear Chemistry Laboratory of the Chemistry Department are described. They include low noise amplifiers for solid state detectors and gridded ionization chambers, fast electronics, power systems for the construction of lithium drifted semiconductors datectors and automatic controls for activation analysis and radiochemical separations. Author

N67-13172*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF TURBINE-TYPE FLOWMETERS IN LIQUID HYDROGEN
Herbert L. Minkin, Howard F. Hobart, and I. Warshawsky Washington, NASA, Dec. 1966 24 p refs
(NASA-TN-D-3770) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Results of calibration experience with 3/4-inch to 2-inch meters in liquid hydrogen are presented. The calibration factor (pulses per unit volume) below nominal full scale remains constant over only about one-sixth of the flow range obtained with water, although the factor is reproducible over much wider flow ranges. Nonreproducibility is such that the maximum deviation of the factor from its mean value at nominal full scale ranges from 0.5 to more than 1 percent, depending on the history of use; the probable deviation is one-half of the maximum deviation. A 50-percent probability exists that the calibration factor of a meter in liquid hydrogen at full scale can be predicted to within 0.7 percent from the water calibration. A 90-percent probability exists that the prediction can be made to within 1.0 percent if there are prior data on meters of the same design, and to within 1.5 percent if there are no such data; in the latter case, the calibration factor in liquid hydrogen must be assumed to be 0.5 percent higher than the calibration factor in water. The influence of piping condition and of pressure drop is also discussed. Author

N67-13174*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATION OF LIQUID-HYDROGEN TURBINE-TYPE FLOWMETER CALIBRATIONS USING HIGH-PRESSURE GAS

Andrew J. Szaniszlo and Lloyd N. Krause Washington, NASA, Dec. 1966 25 p refs
(NASA-TN-D-3773) CFSTI: H$1.00/MF$0.50 CSCL 14B

The accuracy of simulating liquid-hydrogen turbine-meter calibrations by utilizing nitrogen gas at liquid-hydrogen density is established for three different internal configurations of 1.5-inch turbine-type flowmeters. The average of the absolute percent differences for the three sets of turbine meters employed indicates that the liquid-hydrogen calibration factor at full scale can be simulated with 50-atmosphere nitrogen gas to 0.4 percent. For the majority of meters tested, liquid-hydrogen calibrations are simulated more closely by ambient-temperature, high-pressure nitrogen-gas calibrations than by water calibrations. Turbine-meter repeatability, also, is determined for high-pressure nitrogen gas. Typical meter repeatability obtained with nitrogen gas for a 95-percent confidence band is ±0.3 percent. Author

N67-13218*# Chematics Research, Reseda, Calif.
A PRELIMINARY DESCRIPTION OF THE CHEMICAL CAMERA
Roy S. Hickman and Irving R. Tannenbaum Sep. 1966 44 p Prepared for JPL
(Contracts NAS7-100; JPL-951573)
(NASA-CR-80511; Rept.-4001) CFSTI: HC $2.00/MF $0.50 CSCL 14E

Preliminary design details are presented on a spinning cryostat, or chemical camera, which was developed to allow sampling of a supersonic gas stream with submillisecond time resolution. The instrument incorporates a cryopumped skimmer for removing from the view of the rotating cryostat all portions of the gaseous beam which have undergone collision with the walls or otherwise become nonrepresentative of the gaseous beam composition. Thus, the material frozen out on the rotating cryostat will have undergone no interactions after leaving the reaction zone except for the freezing itself. The construction, expected mechanical behavior, and proof tests of the device are described. The tests are to be performed using liquid nitrogen as the refrigerant. After successful operation in this temperature range, the experiments will be repeated using liquid helium to verify the chemistry, and to demonstrate the utility of the chemical camera when liquid helium is the cryogenic liquid. M.G.J.

N67-13228*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
AN INSTRUMENT FOR LUNAR SURFACE CHEMICAL ANALYSIS
Anthony Turkevich, Karlfried Knolle, Richard E. Emmert, Wayne A. Anderson, James H. Patterson (Argonne Natl. Lab.) et al May 1966 44 p refs Submitted for Publication Prepared in cooperation with Argonne Natl. Lab. and JPL
(Contracts NAS7-100; JPL-950750; JPL-950315; Grant NsG-127-61)
(NASA-CR-75747; EFINS-66-49) CFSTI: HC $2.00/MF $0.50 CSCL 03A

An instrument was designed and constructed that utilizes the interactions with matter of monoenergetic alpha particles for surface chemical analysis. The source of alpha particles is a radioactive nuclide such as Cm^{242}. The energy spectra of backscattered alpha particles are measured with semiconductor detectors. Other detectors (with gold foils over them to eliminate alpha particles) register protons from (α,p) reactions. Transistorized electronics provide 128-channel pulse-height analyzers for both alpha and proton spectra. The specific unit designed for the Surveyor Lunar Mission weighs less than 4 kg and uses less than 1.3 watts. Author

N67-13260# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Fiziko-Tekhni Cheskii Institut.
APPLICATION OF THE SIMILARITY METHOD TO RADIATION FIELDS DURING ADJUSTMENT OF NEUTRON RADIATION METERS [PRIMENENIE METODA PODOBIYA RADIATSIONNYKH POLEI PRI NASTROIKE NEITRONNYKH RADIOMETROV]
R. D. Vasil'ev, G. A. Dorofeev, V. I. Petrov, M. I. Pimenov, and V. F. Shevchenko 1966 4 p In RUSSIAN; ENGLISH summary
(NP-16202; Rept.-8)

Metrological laboratories are recently paying increased attention to the problems of calibration of neutron equipment. The adjustment of neutron radiometers with neutron sources based on the similarity of radiation fields formed by appropriate sources which may differ in intensity but which have identical energy spectra is discussed. The sources used were gamma–beryllium (Sb–, Ra–, Na–), alpha–beryllium (Pu–, Po–, Ac–, Ra–), spontaneous fission (^{240}Pu), and nuclear reaction [D(d,n)^{3}He, T(d,n)^{4}He] sources, and the radiation similarity system was compared with conventional calibration results. While the errors never exceed the calibration tolerances, the adjustment time using the new method is significantly shorter, the working procedures are considerably safer, while the calibration ranges are larger by 2 or 3 orders of magnitude as compared with conventional calibration procedures. NSA

N67-13301# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
REQUIREMENTS ON THE OPTICAL UNITS OF STEREOSCOPIC CAMERAS USED IN BUBBLE CHAMBERS [TREBOVANIYA PRED'YAVLYAEMYE K OPTICHESKIM GOLOVKAM STEREOFOTOAPPARATOV, PRIMENYAEMYKH NA PUZYR'KOVYKH KAMERAKH]
E. M. Andreev, G. Libman, and G. I. Selivanov 1966 12 p refs In RUSSIAN Submitted for Publication
(JINR-P-2728)

To facilitate the adjustment of stereoscopic cameras used in bubble chambers it is advisable to manufacture the optical part of these cameras as separate units. Some requirements are imposed on the accuracy of manufacturing of these units. Estimates are given by the example of the optical unit of the stereoscopic camera for an 8-liter liquid hydrogen bubble chamber. The chosen construction allows to provide easily required accuracy of manufacturing of the stereoscopic camera optical unit and guarantees the reliability of the operation of the system. Author (NSA)

N67-13313# Tokyo Univ. (Japan). Inst. for Nuclear Study.
SINGLE RACE (REACTION CONVERSION ELECTRON) SPECTROMETER
M. Sakai, T. Yamazaki, H. Ejiri, and M. Ishihara 1 Jul. 1966 18 p refs
(INSJ-99)

The design and performance of a beta spectrometer, which is especially suited for the measurement of conversion electrons from nuclear reactions, are reported. Author (NSA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N67-12431# Joint Publications Research Service, Washington, D. C.
REDUCTION OF FRICTION IN DEVICES BEARINGS
I. M. Sivokonenko, K. N. Yavlenskiy, and L. V. Semenov *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 142–146 refs (See N67-12401 03-14) CFSTI: $4.00

The result is presented of an experimental investigation of the moment of frictional forces in conventional radial-support bearings and in bearings with a three-point contact, with forced motion of the external or internal rings. Author

N67-12460# Institute of Modern Languages, Inc., Washington, D. C.
ABSORPTION PROCESSES DURING THE USE-UP OF ADDITIVES [ADSORBZIONYE PROZESSY PRI SRABATYVANYI PZISADOK]
V. I. Voroshchikhina, A. V. Nepogadiev, and L. S. Riasanov Ft. Belvoir, Va., Army Engr. Res. and Develop. Labs., Sep. 1966 9 p refs Transl. into ENGLISH from Khim. i Takhnol. Topliv i Masel (Moscow), no. 11, Novj 1965 p 50–52
(Contract DA-44-009-AMC-1563(T))
(T-1866-66; TT-66-62200; AD-638670) CFSTI: HC $1.00/MF $0.50

Conclusions: In case of the work of oil with an additive in a motor, processes of the absorption and desorption of the additive on the motor parts take place in addition to the chemical interaction of the additive with the products of fuel combustion and oil oxidation. The sharp decrease in the concentration of the active additive in the oil during the first hours of the work of the oil is explained mainly by the adsorption of the additive on the motor parts (and if filters are present in the lubrication system, on them too). In the course of further operation, part of the adsorbed additive is desorbed and is returned to the oil. Results governing the consumption of the additive established on the basis of short-term tests cannot be extrapolated for a longer working period of the oil. Author (TAB)

N67-12635# Aktiebolaget Atomenergi, Stockholm (Sweden).
FAILURE OF INCONEL INSPECTION TUBES
Oct. 1966 4 p
(AE-246, suppl.) CFSTI: HC $1.00/MF $0.50

Results are summarized of an investigation of a heavy water leakage due to cracks in three Inconel 600 inspection tubes at the Agesta Nuclear Power Station. The failures encountered show that Inconel 600 under certain conditions may be susceptible to intercrystalline stress corrosion cracking in alkaline high temperature water. R.N.A.

N67-12656# Joint Publications Research Service, Washington, D. C.
MASTERING THE ROLLING OF ROUND SHAPES FROM TITANIUM ALLOYS
N. Ye. Krasnikov, S. A. Kushakevich, P. Ya. Tokmakov, K. A. Kazakov, O. K. Shilin et al *In its* Soviet Res. on Titanium Alloys 28 Oct. 1966 p 26–33 refs Transl. into ENGLISH from Tsvetn. Metal (Moscow), no. 8, Aug. 1966 p 77–80 (See N67-12656 03-17) CFSTI: $2.00

The roll pass design to produce round shapes of 25–60 mm diameter on a 450 mill from malleable round billets with a 127 mm diameter and 1000–2000 mm length, is described. The billets were first heated in an induction furnace with open and with closed windows to temperatures of 1170°, 1270°, and 1370°K. A schematic of the roll pass designs is included, and machining allowance for spreading during the hot rolling was emphasized. Temperature and pressure measurements are described. It was concluded that the finished rolled stock is basically satisfactory. N.E.N.

N67-12701*# Boeing Co., Seattle, Wash. Chrysler Corp., New Orleans, La.
SATURN MANUFACTURING REVIEW
[1966] 14 p Minutes of Meeting Held at Michoud Assembly Facility, New Orleans, 24–25 May 1966 Sponsored by NASA Prepared Jointly With Chrysler Corp.
(NASA-CR-80274) CFSTI: HC $3.00/MF $0.75 CSCL 13H

CONTENTS:

1. OUT OF VACUUM ELECTRON BEAM WELDING P. G. Parks (NASA, Marshall Space Flight Center) p 1–10b (See N67-12702 03-15)

2. MANUFACTURING PROBLEMS ON THE LEM PROGRAM COUPLER ASSEMBLY E. W. Moles (Grumman Aircraft Eng. Corp.) p 11–13 (See N67-12703 03-15)

3. WELD REPAIR OF LAUNCH VEHICLE FUEL AND LOX CONTAINERS E. Stone (Douglas Aircraft Co., Inc.) p 15–16 (See N67-12704 03-15)

4. INDUCTION BRAZING P. J. Kanzler (Grumman Aircraft Eng. Corp.) p 17–20 (See N67-12705 03-15)

5. N. C. CONTOURING WITH A PUNCH PRESS W. D. Otto (Chrysler Corp.) p 21–23 (See N67-12706 03-15)

6. ENVIRONMENTAL CONTROL SYSTEM (ECS) SPACE RADIATOR FABRICATION J. E. Mc Kee (N. Am. Aviation, Inc.) p 25–26 (See N67-12707 03-15)

7. THE BULGE FORMING PROCESS J. A. Beasley p 27–28 (See N67-1270803-15)

8. HIGH ENERGY FORMING OF COMPOUND CONTOURS AND COMPLEX CROSS SECTIONS L. Frost (N. Am. Aviation, Inc.) p 29 (See N67-12709 03-15)

9. SPACE VEHICLE PRODUCTION AND ATTENDANT REQUIREMENTS J. S. Sheldon (Chrysler Corp.) p 31–32 (See N67-12710 03-15)

10. CONTRIBUTION BY MANUFACTURING TO THE RELIABILITY PROGRAM O. Eisenhardt (NASA, Marshall Space Flight Center) p 33–35 (See N67-12711 03-15)

11. SPACECRAFT MANUFACTURING DIVISION'S RESPONSIBILITY AFTER THE SPACECRAFT LEAVES THE ASSEMBLY FLOOR W. Dubusker (McDonnell Aircraft Corp.) p 37–38 (See N67-12712 03-15)

12. A METHOD OF SEQUENCING OPERATIONS AND REPORTING TECHNIQUE G. R. Frazier (IBM) p 39–40 (See N67-12713 03-15)

13. MECHANICAL MACHINE TOOL UTILIZATION IN SUPPORT OF MANUFACTURING RELIABILITY A. C. Graham (Rocketdyne) p 41–42 (See N67-12714 03-15)

14. VEHICLE PROJECT ADMINISTRATION F. T. Wells, Jr. (N. Am. Aviation, Inc.) p 43–44 (See N67-12715 03-15)

15. TOOL EXPERIMENTS FOR ASSEMBLY, MAINTENANCE AND REPAIR IN SPACE R. J. Schwinghamer (NASA, Marshall Space Flight Center) p 45–46 (See N67-12716 03-15)

16. WELD QUALITY ASSURANCE J. J. Bodner (Boeing Co.) p 47–48 (See N67-12717 03-15)

N67-12702*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OUT OF VACUUM ELECTRON BEAM WELDING
P. G. Parks *In* Boeing Co. Saturn Mfg. Rev. [1966] p 1–10 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

An overview is presented of electron beam welding developments; and, in order to illustrate the present status of a NASA program a description is given of a demonstration film, entitled, "Electron Beam out of Vacuum as an Automatic Welding Head." This depicts an electron beam operating in air, and concentrating 350 times more heat in a given area than does the most efficient conventional welding process. Concentrated energy is taken to mean more welding with less overheated material, higher welding speeds; and less stress, cracking, and warping. The unit was specifically designed for complete vacuum-to-nonvacuum

flexibility and portability, and all-purpose X-ray shielding is achieved by a lead-plywood enclosure. Freedom from porosity is achieved when auxiliary inert gas shielding is properly applied and good cleaning is accomplished. M.W.R.

N67-12703*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
MANUFACTURING PROBLEMS ON THE LEM PROGRAM COUPLER ASSEMBLY
E. W. Moles *In* Boeing Co. Saturn Mfg. Rev. [1966] p 11–13 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

The Luner Excursion Module (LEM) program coupler assembly of the LEM mission programmer consists of 17 modules, 12 of which perform 256 distinct switching functions on remote control. Commands from the LEM guidance computer, program reader assembly, and digital command assembly are processed and routed by the coupler assembly to the various vehicle subsystems. Various manufacturing processes and problems related to the coupler assembly are discussed, and it is noted that electronic module welding has been successfully used in the production process. M.W.R.

N67-12704*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
WELD REPAIR OF LAUNCH VEHICLE FUEL AND LOX CONTAINERS
Eric Stone *In* Boeing Co. Saturn Mfg. Rev. [1966] p 15–16 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

The three main categories of weld repair methods currently used on the structural membrane of welded aluminum fuel and liquid oxygen containers for the Saturn S-IVB program include: (1) mechanized repair of the original weld in the same tooling and with the same equipment used for the original weld; (2) out-of-position mechanized repair of the original weld with specially developed tooling and equipment; and (3) out-of-position repair requiring redesign of the weld joint and replacement of the defective joint. For the first two categories, the necessary grind-out to remove the weld defect is simulated on a test panel. For the last type of repair, modification of the jamb fitting weld is used as an example; and full scale doublers, installed on 5-foot domes, were completely tested in a special test fixture prior to the rework of the production hardware. M.W.R.

N67-12705*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
INDUCTION BRAZING
Paul J. Kanzler *In* Boeing Co. Saturn Mfg. Rev. [1966] p 17–20 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

A brazed joint concept is described which utilizes capillary flow of the gold braze alloy in two directions to insure greater surface area, additional strength, and a more reliable seal. The process eliminates port inspection holes and utilizes larger diameter brazing than conventional methods; and diameter to frequency ratio of braze joint is approximately 3:1. Cleaning cycle used on the tubing is outlined. M.W.R.

N67-12706*# Chrysler Corp., New Orleans, La.
N. C. CONTOURING WITH A PUNCH PRESS
W. D. Otto *In* Boeing Co. Saturn Mfg. Rev. [1966] p 21–23 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Use of numerically controlled equipment is discussed in connection with production of the Saturn I and IB boosters. The initial application with a turret punch press resulted in a reduction of man hours for the production of sheet metal brackets that were rectilinear in both profile and hole pattern. A problem, however, remained because some of the metal components did not have regular rectangular profiles. A technique for programming contours on an automatic press was instituted which proved accurate to within 0.003 in, did not overload the machine, and reduced programming time. The NC programmer defines the part geometry and outlines the cutting sequence and then selects the punches that produce the desired periphery with a minimum number of steps. Part costs have been reduced, and the need for tooling and layouts on flat-pattern sheet metal components of the Saturn booster has been virtually eliminated. M.W.R.

N67-12707*# North American Aviation, Inc., Tulsa, Okla.
ENVIRONMENTAL CONTROL SYSTEM (ECS) SPACE RADIATOR FABRICATION
J. E. Mc Kee *In* Boeing Co. Saturn Mfg. Rev. [1966] p 25–26 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Requirements and problems related to the fabrication of environmental control system (ECS) space radiators are discussed. Designed to dissipate heat generated within the spacecraft through the use of a water glycol coolant pumped through the radiator tubes, these space radiators also serve as structural components of the space module. Internal sizing of tubes is considered in terms of meeting flow and pressure drop requirements of the system. M.W.R.

N67-12708*# Boeing Co., Seattle, Wash.
THE BULGE FORMING PROCESS
J. A. Beasley *In its* Saturn Mfg. Rev. [1966] p 27–28 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Pressure vessels of 1000 psig capability were used in the bulge forming tool design for the gores of the Saturn first stage booster; and due to their size and varying design features, the apex and base gore sections were bulge formed separately. During gore section forming, certain areas of the aluminum sheets had excessive thin out due to the peripheral clamping procedure; and chemical milling to leave excess material as well as pre-sculpturing were used to correct for thin out. The final step was to pre-sculpture all apexes and bases before bulge forming to the desired contour. The scrap rate was 3% in forming 925 sections. M.W.R.

N67-12709*# North American Aviation, Inc., Los Angeles, Calif.
HIGH ENERGY FORMING OF COMPOUND CONTOURS AND COMPLEX CROSS SECTIONS
Lou Frost *In* Boeing Co. Saturn Mfg. Rev. [1966] p 29 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Mention is made of the production of waffles, gores, dollars, and elbows for the Saturn S-II program, as well as the explosive forming of waffled ogive-shaped bags for use in brazing tubular rocket engines. Densification of powdered metal compacts of certain materials and various densified shaped bodies are also mentioned. M.W.R.

N67-12710*# Chrysler Corp., New Orleans, La.
SPACE VEHICLE PRODUCTION AND ATTENDANT REQUIREMENTS
John S. Sheldon *In* Boeing Co. Saturn Mfg. Rev. [1966] p 31–32 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Master schedules and other managerial techniques used to achieve the desired quality, production schedules, and cost control in the manufacturing of space vehicle end products are discussed. Programming is considered the most important element in the continuous exercise of management authority in a complex organization, and provisions must be made for coordinating the efforts of individual organizational elements with those of the overall organization. M.W.R.

N67-12711*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONTRIBUTION BY MANUFACTURING TO THE RELIABILITY PROGRAM
Otto Eisenhardt *In* Boeing Co. Saturn Mfg. Rev. [1966] p 33–35 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Demands on manufacturing to maintenance reliability are stressed in connection with equipment for manned space operations; and team effort throughout the manufacturing plant is considered essential to the accomplishment of any reliability program. Procedures adopted for the administration of a reliability program for space vehicle development include the listing of defect categories and code numbers, reporting of defect trends, and preparation of a monthly defect analysis report to management. Determination of operational function, area of occurrence, and primary causes is mandatory; as are the acceptance of responsibility and the preparation of organization performance charts and trend charts by manufacturing discipline. M.W.R.

N67-12712*# McDonnell Aircraft Corp., St. Louis, Mo.
SPACECRAFT MANUFACTURING DIVISION'S RESPONSIBILITY AFTER THE SPACECRAFT LEAVES THE ASSEMBLY FLOOR
William Dubusker *In* Boeing Co. Saturn Mfg. Rev. [1966] p 37–38 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Responsibility for the spacecraft after it has been assembled, tested, and shipped to a remote site is considered to remain with the manufacturing facility. Under this project concept of responsibility, manufacturing personnel participate in the launch operation. Close contact is maintained between manufacturer and launch operation throughout the life of the spacecraft. M.W.R.

N67-12713*# International Business Machines Corp., New York.
A METHOD OF SEQUENCING OPERATIONS AND REPORTING TECHNIQUE
Gerald R. Frazier *In* Boeing Co. Saturn Mfg. Rev. [1966] p 39–40 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Parts availability, parts installation, and sequence to assembly and parts status are considered the basis of a reporting technique and a method of sequencing operations. Data systems combined with the technique include the engineering bill of materials, manufacturing routing parts list, and production control inventory status system. Inputs from production control, purchasing, manufacturing, cost engineering, and cost and manufacturing engineering are combined to provide one set of information; and implementation of the system occurs without increase in work when the right input format is used by each of the groups. Engineering change activity has been facilitated by this coordinated reporting method. M.W.R.

N67-12714*# Rocketdyne, Canoga Park, Calif.
MECHANICAL MACHINE TOOL UTILIZATION IN SUPPORT OF MANUFACTURING RELIABILITY
Arnold C. Graham *In* Boeing Co. Saturn Mfg. Rev. [1966] p 41–42 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

A mechanized direct labor data collection system is utilized to provide information on the available manned-machine time of a large manufacturing plant, down-time for maintaining the production population, productive time; and parts, orders, and quality inspection record for each product completed on machine tools. This mechanized machine tool utilization program, based on a man-machine relationship, permits the use of existing mechanized accounting records to produce low-cost reporting on each individual record. Outputs of the system, used in support of the overall reliability program, can eliminate the use of marginal or unloaded machines, trace parts defects associated with equipment, correct the cause of scrap and overwork, and supplement general plant management. M.W.R.

N67-12715*# North American Aviation, Inc., Downey, Calif.
VEHICLE PROJECT ADMINISTRATION
F. T. Wells, Jr. *In* Boeing Co. Saturn Mfg. Rev. [1966] p 43–44 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

In order to emphasize the integrated "vehicle stack" aspect of manufacturing control during the production stage, a Vehicle Project Administration was developed to provide constant surveillance of Apollo manufacturing progress on a vehicle-by-vehicle basis. This administration coordinates activities, maintains current schedules and cost performance data, frees senior personnel from routine tasks, and is responsible for manufacturing fabrication of work packages. M.W.R.

N67-12716*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TOOL EXPERIMENTS FOR ASSEMBLY, MAINTENANCE AND REPAIR IN SPACE
Robert J. Schwinghamer *In* Boeing Co. Saturn Mfg. Rev. [1966] p 45–46 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Advantages of energy storage and the pulse power concept; as well as the need for high power for assembly, maintenance, and repair operations in space were discussed. Attention was given to a typical solar charged pulse power system, existing pulse power tools, development of apparatus and techniques for creating cohesion and adhesion in vacuum environments of 10^{-9} Torr or less, and benefits of neutral buoyancy immersion techniques for space tool development. M.W.R.

N67-12717*# Boeing Co., Seattle, Wash.
WELD QUALITY ASSURANCE
John J. Bodner *In its* Saturn Mfg. Rev. [1966] p 47–48 (See N67-12701 03-15) CFSTI: HC $3.00/MF $0.75

Certification of welding procedures is conducted to demonstrate that a particular combination of operator, tooling, and settings will produce acceptable quality assurance results for the Saturn S-IC assembly. Certification is performed by the manufacturing department and monitored by the quality assurance department, with standards set by engineering; and certifications requirements are destruct tested to verify adherence to these requirements. Inspection techniques used in the evaluation of Saturn I-C weldments are varied, with the radiograph the prime method. Apparatus has been designed to provide rapid exposure processing through the use of roll film and mechanized weld traverse, and to provide readout results in a minimum flow time by automatic film processing. Defect trend reporting is used to pinpoint areas in or approaching an out of control condition. M.W.R.

N67-12814# Joint Publications Research Service, Washington, D. C.
DESIGN FEATURES AND TECHNOLOGY OF MANUFACTURING THIN-WALLED CASTINGS FROM STRUCTURAL, WELDABLE HIGH STRENGTH STEELS
Yaj Ye. Chivlksin and D. R. Kononov *In its* Steel Casting and Foundry Work in the USSR, 9 Nov. 1966 p 22–27 (See N67-12810 03-17) CFSTI: $2.00

Recent technological advances in casting thin walled structures are reviewed. The difficulty in filling the thin sections of the casting with steel, the tendency of hot crack formation, the difficulty in assuring casting dimensions within set limits, and the characteristics of casting feed are described. Data on mechanical properties of pre-cast high strength steels and of specimens cut from various sections of actual castings are tabulated. N.E.N.

N67-12815# Joint Publications Research Service, Washington, D. C.
INVESTMENT CASTING OF Cr–Ni STEEL VANES

M. P. Voronin et al *In its* Steel Casting and Foundry Work in the USSR 9 Nov. 1966 p 28–32 (See N67-12810 03-17) CFSTI: $2.00

Manufacturing features in casting compressor vanes are briefly described. The molding process is included, and surface points defects and their analysis are mentioned. Stable dimensions were obtained using seamless cast models, carbamide rods, and a moist filler in moldmaking. Elimination of surface point defects was attained by facing the first mold layer with a suspension of ethyl silicate and electrocorundum, and using electrocorundum sprinkling. N.E.N.

N67-12880# Union Carbide Nuclear Co., Oak Ridge, Tenn. Gaseous Diffusion Plant.
A STUDY OF THE PERIPHERAL COMPRESSOR
Phillip Stephen Cates (M.S. Thesis--Tennessee Univ.) 26 Aug. 1966 163 p refs
(Contract W-7405-ENG-26)
(U-1665) CFSTI: HC $5.00/MF $1.00

The study had three objectives: (1) determine the "state of the art" by conducting a thorough survey of the available literature on peripheral pumps and compressors; (2) analyze the published theories for incompressible flow and propose a hypothesis for performance in compressible flow; and (3) obtain experimental data on gases for correlation with respect to the proposed hypothesis. The theories for incompressible flow operation were summarized and studied with regard to their limitations for application to compressible flow operation. Fundamental laws of continuity, thermodynamics, and motion for compressible flow were applied to control volumes in the peripheral compressor in the form of integral vector relations. From these equations, from experience in compressible flow problems, and from published literature on centrifugal compressor studies, qualitative predictions for peripheral compressor performance at high impeller Mach numbers were made. Functional relationships of dimensionless parameters were derived for correlation of experimental data measured in compressible flow. Data were obtained on an experimental compressor at speeds from 5000 to 14,000 rpm in gases with molecular weights of 4 to 400. In addition to the effects of Mach number, the influence of channel, impeller, and nozzle geometries and impeller-to-casing clearances were investigated. Generally, the experimental data confirmed the qualitative predictions for compressible flow operation. The peripheral compressor operated stably at all speeds and flows but exhibited some limitations at high Mach number operation. Methods to improve performance, particularly at high impeller Mach numbers, were developed, and significant advancement of design information was achieved. Author (NSA)

N67-12896# Royal Aircraft Establishment, Farnborough (England).
THE TECHNOLOGY OF GLASS FILAMENT WINDING [LA TECHNOLOGIE DU BOBINAGE DU FIL DE VERRE]
Georges Jube Jul. 1966 31 p Transl. into ENGLISH from Air Tech. (Boulogne), no. 3, 1965 p 122–136
(RAE-LIB-TRANS-1176) CFSTI: HC $2.00/MF $0.50

The problems of producing filament wound structures are considered, with particular reference to rocket motor casings. The advantages of isotensoidal lay-up are suggested and an apparatus developed to study its adaptation is described. Helical and polar winding machines are studied and criteria offered to allow choice between them. Mandrels have been developed; light alloy mandrels and soluble mandrels of sand and polyvinyl alcohol appear preferable. Problems of inspection and control at all stages of manufacture are considered in detail. Author

N67-12920*# Martin Co., Denver, Colo.
COMMON BULKHEAD JOINT DEVELOPMENT AND EVALUATION Final Report
E. J. Beck and J. A. Mallon Jul. 1966 87 p ref
(Contract NAS8-20125)
(NASA-CR-80155; Martin CR-66-47) CFSTI: HC $3.00/MF $0.75 CSCL 13H

A three phase program was conducted to optimize the welded joint design for the Saturn booster common bulkhead using a structural analysis approach and to obtain experimental data for various combinations of geometries and material to confirm the analytically obtained design. Phase I was to establish an optimized honeycomb weld joint using three aluminum alloys with two skin thicknesses. Phase II was to experimentally determine the behavior of optimum designed honeycomb joints for six combinations of materials and thicknesses under compressive loading and to compare this behavior with that predicted by design studies. Phase III was to compare a combination welded-bonded joint with the optimized welded joint. Phases I and II confirmed that the structural analysis approach can be used to design optimum welded composite joints. Experimental confirmation of predicted performance showed excellent agreement between theory and experiment. Results from the not fully optimized welded-bonded panels designed and tested in Phase II showed higher strength than the Phase II welded panels. Fabrication was the most serious problem found in applying the prebonded common bulkhead. The Phase III design would make fabrication of structural items much simpler. R.N.A.

N67-12937*# General Electric Co., Philadelphia, Pa.
DEVELOPMENT OF ENERGY DISSIPATING PLASTIC HONEYCOMB Quarterly Progress Report No. 4, Apr. 1–Jul. 31, 1966
1 Aug. 1966 26 p Prepared for JPL
(Contracts NAS7-100; JPL-951172)
(NASA-CR-80190; DIN-66SD4441) CFSTI: HC $2.00/MF $0.50 CSCL 13H

Static crushing tests were performed on 14 pcf thinned dip honeycomb specimens after they had been exposed to a sterilization cycle. Unsterilized material, cut from the same log of honeycomb, was tested and used for comparison of energy absorption values. No significant change in material properties of the sterilized specimens was observed. Two High-velocity impact tests were conducted on improved bond specimens. Visual observation after impact indicated that the material crushed in an orderly manner; however, no quantitative data were obtained. Tooling used in fabricating the flat dovetail specimens was completely reworked to include all metal parts that replaced wooden parts in the original tooling. It was shown that the size of dovetail design specimens that can be manufactured is limited by the short time cycle available for assembling the piece. S.P.

N67-13011*# Franklin Inst., Philadelphia, Pa. Research Labs.
AN ANALYSIS OF EXPERIMENTAL DATA ON ENTRANCE EFFECTS IN CIRCULAR THRUST BEARINGS
S. P. Carfagno Sep. 1966 24 p refs Sponsored in part by NASA
(Contract NONr-2342(00))
(NASA-CR-80111; I-A2049-28) CFSTI: HC $1.00/MF $0.50 CSCL 13I

An empirical method is presented for taking entrance effects into account in computing flow rates and load-carrying capacities of circular thrust bearings. Because of the limited data on which it is based, the method is applicable only to bearings having an 0.020-in. diameter supply hole; but it can be generalized when data for other supply hole diameters are obtained. When applied to the geometry for which experimental data were available, the procedure yielded values of flow rate and load falling within approximately 10 percent of the experimental values. Author

N67-13026*# Solar, San Diego, Calif.
HIGH PRESSURE LARGE FLOW RATE FLEXIBLE CONNECTOR SYSTEM Final Summary Report
[1965] 187 p refs
(Contract NAS10-1266)
(NASA-CR-80431; Rept.-6-1501-7) CFSTI: HC $5.00/MF $1.00 CSCL 13K

This summary contains the design study and materials selection resulting in a detailed design for the fabrication of a high-pressure, large flow rate flexible connector of flowpipes. Motion studies performed on three gimbal joint systems, and on angulation and axial systems utilizing gimbal joints and compensators, develop as a most promising design concept a gimbal joint that utilizes machined, low-height bellows; the gimbal type structure's rotating pin is an integral part of the flange and thus requires no welds for carrying primary loads. A pressure stability study shows that joint instability or squirm will not occur below 20,000 psi internal pressure. G.G.

N67-13060# Library of Congress, Washington, D. C. Aerospace Technology Div.
STATUS OF SOVIET TUBE-MANUFACTURING TECHNOLOGY FOR AEROSPACE APPLICATIONS--COMPREHENSIVE REPORT Surveys of Foreign Scientific and Technical Literature
Dimitri Vvedensky 5 Aug. 1966 184 p refs
(ATD-66-95)

This comprehensive report is based on Soviet open sources published 1956--1966, with some sources published as early as 1948. The first in a series, its purpose is to determine the status of Soviet tube-manufacturing technology for aerospace applications. The report is divided into five sections: tube specifications; steel tubes; heat resistant nickel-base alloy tubes; nonferrous metal and alloy tubes; refractory metal tubes. It discusses in detail Soviet tube specifications, shows dimensions and tolerances for various tube types, lists tube materials, briefly discusses tube-making processes and equipment, lists names, locations, and equipment of identified tube-making plants, identifies the most probable producers of aircraft tubes, and briefly discusses new developments and improvement in tube-making equipment and production techniques. A bibliography is included. Author

N67-13089# National Engineering Lab., Glasgow (Scotland).
VIBRATIONS IN A HORIZONTAL MILLING MACHINE
J. Tweedie Dec. 1965 45 p
(NEL-207) CFSTI: HC $2.00/MF $0.50

An investigation of the causes of vibration in a milling machine, and of means of damping them, is reported. The work was carried out on a horizontal machine and the origins of vibration were investigated by forced vibration tests and by dynamic cutting tests. The design of the dampers was limited by the space into which they had to be fitted, but a reduction in the level of both torsional and linear vibration was achieved. To obtain the best performance, design of dampers should be integral with that of the machine and its drive systems. Author

N67-13126*# IIT Research Inst., Chicago, Ill. Technology Center.
ENVIRONMENTAL STUDY OF MINIATURE SLIP RINGS Final Report, 1 Jul.--1 Sep. 1966
O. M. Kuritza 1 Sep. 1966 52 p
(Contract NAS8-5251; IITRI Proj. E6000)
(NASA-CR-80488) CFSTI: HC $2.50/MF $0.50 CSCL 13H

A laboratory investigation of the performance characteristics of miniature slip rings in vacuum was conducted. Unacceptable noise levels were developed in a very short time at high vacuum conditions. Noise voltage consisted of low frequency components and was independent of current, at least up to 25mA. Improved noise characteristics were obtained by using commercial vacuum lubricants or a niobium diselenide ring. Hard gold overplating did not result in an improved noise performance. A soft metal vapor plating technique was developed which gave substantially improved performance. Author

N67-13137# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
ELECTROWINNING AND TAPPING OF LANTHANUM METAL
Edward S. Shedd, Jack D. Marchant, and Thomas A. Henrie 1966 13 p refs
(BM-RI-6882)

Electrowinning and tapping lanthanum metal from lanthanum oxide in a fluoride bath is investigated. The electrolyte was composed of LaF_3, BaF_2, and LiF. Metal containing 0.2 percent impurities was produced at a rate of over 2 pounds per hour. Principal impurities were carbon, aluminum, and silicon. Low-carbon metal was produced by continually discharging the carbon oxide gases and maintaining 0.1-atmosphere pressure. Anode reactions and cell design were found to be important factors in cell operation. Both frozen electrolyte skulls and tungsten metal crucibles proved satisfactory for collecting the metal and did not react with the molten lanthanum. Author

N67-13173*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTRUSION OF 1/2- AND 3/8-INCH-DIAMETER, THIN-WALL TUNGSTEN TUBING USING THE FLOATING-MANDREL TECHNIQUE
Charles P. Blankenship and Charles A. Gyorgak Washington, NASA, Dec. 1966 27 p refs
(NASA-TN-D-3772) CFSTI: HC $1.00/MF $0.50 CSCL 13H

Fabrication of small-diameter, thin-wall tungsten tubing by hot extrusion over a floating mandrel was investigated. Variables studied included extrusion temperature, initial density of the tungsten, and composition of the canning material. Successful extrusion of 1/2-inch-diameter tubing over 0.4-inch-diameter mandrels was accomplished at temperatures ranging from 3000° to 4000°F. Tubing of 3/8-inch diameter was extruded successfully over 0.3-inch-diameter mandrels at 4000°F. Nominal wall thicknesses were 0.020 inch, and the maximum usable length was 5 feet. Within the temperature range investigated, 3000° to 4000°F, tubing extruded from tungsten cylinders having a density near 80 per cent of theoretical or greater was fully dense. At 4000°F, fully dense tubing was extruded from approximately 68-percent-dense cylinders. For the best 3/8- and 1/2-inch-diameter tubing, wall thicknesses were within ±0.001 and ±0.002 inch, respectively, and the diameters were within ±0.005 inch. At 3500°F, the tensile strength of the extruded tubing, 8300 to 9600 pounds per square inch, was comparable to that of wrought sintered tungsten. Tubing internally pressurized at 3500°F failed at an average tangential stress ranging from 9500 to nearly 11,000 pounds per square inch. Author

N67-13190*# Little (Arthur D.), Inc., Cambridge, Mass.
ADVANCED STUDIES ON MULTI-LAYER INSULATION SYSTEMS Final Report
1 Jun. 1966 390 p refs
(Contract NAS3-6283)
(NASA-CR-54929; ADL-67180-00-04) CFSTI: HC $4.25/MF $1.75 CSCL 13H

Analytical and experimental studies were reported on the performance of multilayer insulation systems to reduce the heat leak rate into stored cryogenic propellants carried in space vehicles

under varying environments. Emphasis was placed on: (1) use of an emissometer to evaluate new radiation shield materials; (2) operation of a flat plate thermal conductivity apparatus to evaluate spacer material for improved insulation efficiency; and (3) on a series of insulated calorimeter tank experiments. Experimental results showed that multilayer insulations with spacers of two or more materials are most effective because each component can be selected to perform a specific function. Emittance stability of silver and copper coatings was highest under exposure to high humidity, carbon dioxide, and salt environments. Commercial sources of good quality, low emittance shields consisted of polyester film, vacuum metallized on both sides with aluminum, silver and gold; they showed the best emittance values with .025, .011, and .017, respectively. G.G.

N67-13191*# Goodyear Aerospace Corp., Akron, Ohio.
RIGIDIZATION OF A 1.52-METER DIAMETER INFLATABLE SOLAR CONCENTRATOR IN VACUUM WITH ASSOCIATED MATERIAL STUDIES AND FABRICATION TECHNIQUES Final Report
N. Jouriles, C. E. Welling, and J. C. Kryah Dec. 1966 73 p
(Contract NAS1-5513)
(NASA-CR-66114; GER-12679) CFSTI: HC $2.50/MF $0.75 CSCL 13H

Paraboloidal solar concentrator development work was carried out. Precoat foam was used as the rigidizing material for inflatable film type mirrors. 1.52 meter diameter units were rigidized in a vacuum chamber utilizing radiant heat as the heat source for initiation of the foaming reaction. The foam had been previously applied in sheet form to the back of a commercial aluminized polyimide film parabolic membrane. A torus-type backup structure was subsequently attached for mounting in ground test equipment. Relatively good quality mirrors were the result of this development program. Author

N67-13198*# General Electric Co., Philadelphia, Pa. Missile and Space Division.
DEVELOPMENT OF ENERGY DISSIPATING PLASTIC HONEYCOMB Quarterly Progress Report, 1 Aug.–31 Oct. 1966
1 Nov. 1966 54 p Prepared for JPL
(Contracts NAS7-100; JPL-951172)
(NASA-CR-80617; DIN-66SD4530; QPR-5) CFSTI: HC $3.00/MF $0.50 CSCL 13H

Two major changes are being incorporated into this contract. These changes consist of the addition of (1) more elaborate tooling (to fabricate the dovetail specimens) and (2) an investigation to determine the effect on energy absorption of adding glass filler materials to the dip resin used in manufacturing honeycomb specimens. The design of all tooling required to fabricate the large dovetail specimens has been completed, and all long lead time items have been ordered. The fixture to be used for curving the dovetail specimens has been designed and is in the process of being procured. Investigation has been initiated of the addition of filler material to the dip resin and has shown that it is feasible to modify the existing dip resin with either short fibers or flakes of glass. Static and high velocity tests have been conducted on the hexagonal cell. Static tests of the hexagonal cell, thinned dip improved bond, honeycomb have been conducted at temperatures of +200°F and −100°F. Performance is excellent at −100°F and relatively poor at +200°F. High velocity tests, performed thus far, have shown that the hexagonal cell material performance at high velocity is equal to, or greater than, the performance of those measured on static tests. Author

N67-13254# California Univ., Livermore. Lawrence Radiation Lab.
THE SIGNIFICANCE OF THERMAL EFFECTS IN MANUFACTURING AND METROLOGY
Eldon Ray Mc Clure 24 Jun. 1966 17 p refs Presented at the CIRP Ann. Assembly, Paris, Sep. 1966
(Contract W-7405-ENG-48)
(UCRL-14944) CFSTI: HC $1.00/MF $0.50

A survey shows that errors induced in machining and gaging by thermal influences are having a technological and economical impact on the American machine tool industry. The user is often unaware of the actual extent of his own problems since he does not have convenient checking procedures. Success in the attainment of precision machining is at present heavily dependent on the skill of the operator. Increased use of numerically controlled machine tools will force a more methodical effort to overcome thermal problems. Author (NSA)

N67-13315# Bettis Atomic Power Lab., Pittsburgh, Pa.
THEORY AND MECHANISM OF ZIRCALOY PRESSURE BONDING
J. Weber and W. L. Frankhouser Jul. 1966 52 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-305) CFSTI: HC $3.00/MF $0.50

The pressure bonding operation was used to bond Zircaloy cladding components in PWR Core 2 fuel plates containing ceramic wafers. During the development of this process there were many bonding experiments which were never described in the literature. Several of these experiments offer considerable insight into the metallurgical mechanism involved in bonding Zircaloy. They are discussed to prove that bonding is achieved primarily by nucleation and growth across the bondline. Optimum conditions required to obtain excellent metallurgical bonds include removal of surface material, a high degree of surface cleanliness, intimate surface contact, and thermal transformation in the solid–solid region. Surface roughness itself is not a necessary condition, but generally is considered to be an aid in bonding. Optimum operational cycling in the bonding facility requires a simultaneous application of temperature and pressure. Author (NSA)

N67-13335# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
POWER REQUIREMENTS FOR SINGLE-POINT TOOLS
J. R. Blanks 4 Aug. 1966 12 p ref
(Contract W-7405-ENG-26)
(Y-DA-1287) CFSTI: HC $1.00/MF $0.50

A knowledge of the power requirements and the forces acting on a tool is desirable in the design or selection of machine tools. A three-component lathe dynamometer was used to determine the forces acting on a single-point cutting tool while maching cast depleted uranium. Graphs and equations have been developed that show the relation between the tool forces and power required at the tool point and the feed rate and depth of cut. The resultant force varies from approximately 10 pounds for very light cuts to more than 1200 pounds for heavy cuts. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N67-12313*# Mullard Research Labs., Reigate (England).
THE TRAVELLING WAVE MASER AMPLIFIER IN THE GOONHILLY RADIO STATION
J. C. Walling and F. W. Smith *In* NASA. Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2167–2181 refs Submitted for Publication (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

The design and performance of the 4170 Mc/s travelling wave maser at present installed at the GPO Radio Station, Goonhilly Downs, is described. Means of increasing the bandwidth of the device are discussed. Author

N67-12314*# Post Office Engineering Dept., London (England).
THE HELIUM SYSTEM OF THE MASER INSTALLATION AT THE GOONHILLY SATELLITE-COMMUNICATION EARTH STATION
H. N. Daglish and M. R. Child *In* NASA Goddard Space Flight Center Telstar I, Vol. 4 Dec. 1965 p 2183–2193 Submitted for Publication (See N67-12301 03-07) CFSTI: HC $7.48/MF $2.00

A traveling-wave solid-state maser amplifier, immersed in liquid helium for very low temperature operation, is used to provide the first stage of amplification in the receiving system of a communication-satellite earth station. A large vacuum pump is required to cause the helium to boil at reduced pressure and thus attain a temperature lower than 2°K to insure the operation of the ruby–crystalline alumina amplifier. The complete helium control equipment associated with the maser operation consists of a vacuum line along and down the aerial structure to the vacuum pump, equipment for controlling the flow of helium gas from the vacuum pump, and a helium storage container for return to the liquefaction plant. G.G.

N67-12533# General Telephone and Electronics Labs., Inc., Bayside, N. Y. Bayside Lab.
CHELATE LASERS Final Report, 1 Apr. 1963–31 Mar. 1966
A. Lempicki, H. Samelson, C. Brecher Apr. 1966 125 p refs
(Contract Nonr-4134(00); ARPA Order 306; Proj. Defender)
(TR-66-052.13; AD-632178)

The physical properties and operating characteristics of chelate laser systems are defined. The limitations of chelate solutions in such systems are described in terms of the chemical behavior of the component materials, and the chemical and spectroscopic properties of the chelates themselves are elucidated. Approaches for overcoming the intense absorption which limits the performance of chelate lasers are proposed. The document is comprised largely of reprints from the following sources: J. Chem. Physics V40 P2547–2553, P2553–2558 1964; J. Chem. Physics V42 P1081–1096 1965; J. Chem. Physics V41 P1214–1224 1964; J. Chem. Physics V41 P279–280 1964; Applied Physics Letters V2 P159–161 1963; Nature V202 P580–581 1964; J. Chem. Physics V41 P3998–4000 1964; Applied Physics Letters V5 P173–174 1964; Applied Optics Suppl. 2 of Chemical Lasers P205–213 1965. TAB

N67-12645# Naval Research Lab., Washington, D. C.
NRL PROGRESS IN HIGH-POWER LASER RESEARCH Interim Report
10 Jun. 1966 44 p refs
(ARPA Order 660)
(NRL-6444; AD-637616) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. LASER MATERIALS RESEARCH H. W. Gandy, R. J. Ginther, and J. F. Weller p 1–13 refs (See N67-12646 03-26)
2. LASER MATERIALS EVALUATION PROGRAM W. H. Vaughan p 14 (See N67-12647 03-26)
3. MAGNETIC Q-SPOILING OF COOLED RUBY J. N. Bradford, J. W. Tucker, and R. C. Eckardt p 15–18 ref (See N67-12648 03-16)
4. GAS LASER RESEARCH A. W. Ali (Catholic Univ. of Am.), J. D. Shipman, A. C. Kolb, and A. D. Anderson p 19–24 refs (See N67-12649 03-16)
5. BEAM SELF-FOCUSING IN LIQUIDS E. A. Mclean p 25 refs (See N67-12650 03-16)
6. HIGH-POWER LASER DEVELOPMENT J. M. Mc Mahon and B. G. Bricks p 26–29 refs (See N67-12651 03-16)
7. FLASHLAMP SPECTROSCOPY F. D. Harrington p 30–38 ref (See N67-12652 03-23)

N67-12648# Naval Research Lab., Washington, D. C.
MAGNETIC Q-SPOILING OF COOLED RUBY
J. N. Bradford, J. W. Tucker, and R. C. Eckardt *In its* NRL Progr. in High-power Laser Res. 10 Jun. 1966 p 15–18 ref (See N67-12645 03-16) CFSTI: HC $2.00/MF $0.50

Q-switching of a wall-pumped ruby laser was initiated by the triggering of a spark gap discharge of a 2-μF capacitor charged to 20,000 V. This fast discharge opposed the relatively slow magnetizing current so that the net coil current went down to zero and reversed in polarity. Several oscillograms were made showing the Q-switched output with the end faces of the ruby serving as the cavity mirrors. G.G.

N67-12649# Naval Research Lab., Washington, D. C.
GAS LASER RESEARCH
J. D. Shipman, A. C. Kolb, A. D. Anderson, and A. W. Ali (Catholic Univ. of Am.) *In its* NRL Progr. in High-Power Laser Res. 10 Jun. 1966 p 19–24 refs (See N67-12645 03-16) CFSTI: HC $2.00/MF $0.50

Described is an experimental gas laser system atop a water dielectric capacitor that is able to study gas lasers at higher currents and current densities than usual. The system uses demineralized water as an insulator for the 2-μsec charge involved; the water dielectric capacitor is pulse charged through a step-up transformer to a peak current of 150 kA at 300 kV. Aluminum concave mirrors and quartz windows insure a wide spectral range output. Lasing was observed with argon, neon, and mixtures of argon, neon, and air. About equal parts of argon and dry air at a pressure of 0.02 torr gave about 0.5 watt output in the visible at 4765Å. The greatest output was 5 to 10 W, obtained in the ultraviolet at 3511 Å. A high power nitrogen laser of about 30 torr was obtained by a 180 cm long discharge channel with electrode spacing of 1.7 cm. A computer program was written for a laser system with up to five energy levels and the equations governing the population densities of the upper and lower levels of the lasing line are presented. G.G.

N67-12650# Naval Research Lab., Washington, D. C.
BEAM SELF-FOCUSING IN LIQUIDS
E. A. Mc Lean *In its* NRL Progr. in High-Power Laser Res. 10 Jun. 1966 p 25 refs (See N67-12645 03-50) CFSTI: HC $2.00/MF $0.50

Spatial changes in the refraction index as a function of time when an intense light beam passes through a liquid were observed. Time-integrated photographs taken of a giant laser pulse (≈150 MW) traveling through a water cell showed evidence of self-focusing and trapping for the light beam. G.G.

N67-12651# Naval Research Lab., Washington, D. C.
HIGH-POWER LASER DEVELOPMENT
J. M. Mc Mahon and B. G. Bricks *In its* NRL Progr. in High-power Laser Res. 10 Jun. 1966 p 26–29 refs (See N67-12645 03-16) CFSTI: HC $2.00/MF $0.50

The principle of the Faraday Q-switch for high power laser output is discussed and experimental results with a Faraday-active material are reported. A vertically polarized light beam output

from a 60-degree-cut ruby was reflected from quartz plates at Brewster's angle when there was no magnetic field present; a 90 degree rotation of the plane of polarization of the ruby laser in the Faraday-active material by pulsed magnetic field resulted in a giant pulse and eliminated any reflection loss. G.G.

N67-13063# Radio Corp. of America, Princeton, N. J. RCA Labs.
LASERS FOR DIGITAL DEVICES
Walter F. Kosonocky (Ph.D. Thesis--Columbia Univ.) *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 23–77 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00
(Contract AF 30 (602)-3169)

Continuously pumped lasers are considered as components for digital circuits in which all of the processing signals are in the form of optical energy. The operation of the laser digital circuits is based on signal gain derived from a laser amplifier and nonlinear (saturable) response of optical materials to laser signals. The two nonlinear processes are quenching of the output of a laser oscillator and saturation of optical absorption. A laser inverter, a laser bistable oscillator, and a laser monostable oscillator are examined as switching devices that could be implemented with GaAs lasers. The GaAs laser inverter is further evaluated as a general-purpose switching circuit, and experimental tests of the operation of this device are reported. The operation of a laser relaxation oscillator and a laser monostable circuit was demonstrated experimentally with ruby lasers having inside their resonant cavities, solutions of phthalocyanine as the saturable absorbers. A digital signal gain of two was achieved in the test of the ruby monostable circuit. Author

N67-13064# Siemens and Halske A. G., Munich (West Germany). Central Labs.
OPTICAL PULSE AMPLIFIERS WITH ACTIVE SATURABLE ABSORPTION SWITCHES
Dieter Roess *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 79–90 refs (See N67-13061 03-23) CFSTI: HC $5.21/MF $2.00

A laser oscillator, whose resonator is blocked by a saturable filter, is a bistable device. Saturation of the filter by an external optical device will switch the oscillator "on". By using systems with more than one resonator, the oscillator can be switched off by one signal at one port, and on by another signal at another port. The light components can be combined with electro-optic input and output. Basic elements and more complex configurations are described. Transients of the order of 10^{-11} seconds will be possible, using semiconductor elements. High sensitivity is achieved by using filters, whose saturation is frequency-selective. Experiments with selectively saturable substances are described. Author

N67-13069# Spectra-Physics, Inc., Mountain View, Calif.
LOW POWER, WIDE BANDWIDTH LASER MODULATORS
James L. Hobart *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 165–177 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

Recent advances in electro-optic modulators now permit large modulation bandwidths at low driving voltages. Present emphasis centers on three classes of devices: temperature compensated transverse Pockel's effect type, the multiple-cell type using the longitudinal Pockel's effect, and the room temperature paraelectric perovskites. The physical principles of each of these devices are reviewed and their present state of development summarized. Examples of the application of these devices to optoelectronic systems are given. Author

N67-13120*# Miami Univ., Coral Gables, Fla. School of Environmental and Planetary Sciences.
REPORT ON LASER BACK-SCATTER SYSTEM AND SUBSYSTEMS Semiannual Status Report
Luis M. Herrera-Cantilo Nov. 1966 46 p refs
(Grant NGR-10-007-028)
(NASA-CR-80441) CFSTI: HC $2.00/MF $0.50 CSCL 20E

A laser system used for backscattering experiments, is described in detail. The transmitter; the fluorescence shutter; the receiving telescope and optical receiver; the high speed shutter; the detector and detector housing; the preamplifier; the video amplifier and threshold detector; and the timing and display units are described. Also discussed are the transmitter output, and the operation of the timing unit. A procurement time schedule for the project; and circuit diagrams of the various parts of the system are given. L.S.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N67-12387# Virginia Polytechnic Inst., Blacksburg. Dept. of Metals and Ceramic Engineering.
THE RELATIONSHIP OF NITROGEN CONTENT OF A HIGH PURITY 20-20 AUSTENITIC STAINLESS STEEL TO STRESS CORROSION Final Report
John F. Eckel, R. E. Smith, and A. B. Greene 30 Jul. 1966 25 p refs
(Grant DA-ARO(D)-31-124-G441)
(AROD-4099-2; AD-639216) CFSTI: HC $1.00/MF $0.50

The problem of stress corrosion cracking in austenitic stainless steels containing nitrogen has been studied, using a high purity 20 percent chromium, 20 percent nickel steel. The approach to the problem consisted of the determination of physical characteristics of the alloy as affected by nitrogen and the possibilities of nitrogen causing aging in such steels which could be associated with susceptibility to stress corrosion cracking. Specimens containing varying amounts of nitrogen were prepared and subjected to a dilatometric analysis on heating to 180C, and the volume changes were studied, to observe solid state reactions in the alloy in this temperature range. A unique dilatometer was designed and constructed which permits the applications of constant tensile stresses over the range of temperature of interest. Specimens were tested in this instrument at various stress levels and at a constant heating rate. Internal friction measurements were also made by means of a torsional pendulum in the temperature range from ambient room temperature up to 300C. Author (TAB)

N67-12653# Texas Univ., Austin. Engineering Mechanics Research Lab.
CRACK INITIATION IN FATIGUE OF METALS Final Scientific Report
Melvin A. Wilkov and Richard Shield May 1966 61 p refs
(Grant AF-AFOSR-560-65)
(EMRL-RM-1012; AFOSR-66-0858; AD-640419L) CFSTI: HC $3.00/MF $0.75

The origin and progressive growth of the fatigue crack on the surface of single and polycrystalline face centered cubic metals subjected to cyclic deformation were observed with an electron microscope. Unique features of the investigation were the

successive examination of a selected area on the surface of a specimen and the selection of crystal orientation so that the active slip system and the Burgers vectors of the contributing dislocations could be more accurately defined. Fatigue damage was observed to begin as a sequence of small cavities oriented on the slip traces, which increase in number and size, ultimately joining to form either a continuous microcrack or shallow surface intrusion. Variation of temperature (4.2K to 300K), stress amplitude, and number of active slip systems does not change the basic process of crack initiation, but only the rate and mode of cavity coalescence. A tentative explanation of the mechanism of fatigue is proposed based on this work and other previous investigations. Author (TAB)

N67-12656# Joint Publications Research Service, Washington, D. C.

SOVIET RESEARCH ON TITANIUM ALLOYS

28 Oct. 1966 39 p Transl. into ENGLISH from Russian (JPRS-38370; TT-66-34796) CFSTI: HC $2.00

Research interest focused on the kinetics of phase transformations; techniques for increasing the strength of titanium alloy containers, and for rolling round shapes; and the influence of additives on titanium alloy properties. For individual abstracts, see N67-12657–N67-12660. M.G.J.

N67-12657# Joint Publications Research Service, Washington, D. C.

KINETICS OF PHASE TRANSFORMATIONS IN VT-15 ALLOY WELD JOINTS

V. F. Grabin, V. G. Vasil'yev, A. Kushnirenko, V. N. Zamkov, and A. A. Gordonnaya *In its* Soviet Res. on Titanium Alloys 28 Oct. 1966 p 1–12 refs Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 6, Jun. 1966 p 10–15 (See N67-12656 03-17) CFSTI: $2.00

The phase transformations were studied using dilatometric, electron diffraction, and metallographic methods. The procedures are outlined, and the data is graphed. Among the conclusions are: (1) The presence of a $\beta \rightarrow \omega$ transformation is established, and the formation of a $TiCr_2$ compound is considered a possibility. (2) Martensite $\beta \rightarrow \omega$ transformation at temperatures up to 200°C occurs without preliminary diffusion redistribution of the elements. (3) The volume effects of transformation in the seams are small. (4) Alteration of the composition of the solid solution in the border zone precedes the $TiCr_2$ formation. (5) Welded compounds must be hardened at 900° to ensure the optimum combination of strength and plasticity. N.E.N.

N67-12658# Joint Publications Research Service, Washington, D. C.

INFLUENCE OF ADDITIVES ON THE PROPERTIES OF TITANIUM ALLOYS

A. I. Khorev, S. G. Glazunov, and L. G. Mukhina *In its* Soviet Res. on Titanium Alloys 28 Oct. 1966 p 13–20 refs Transl. into ENGLISH from Tsvetn. Metal (Moscow), no. 7, Jul. 1966 p 86–88 (See N67-12656 03-17) CFSTI: $2.00

The structure and properties of titanium alloys thermally strengthened by introducing small amounts of zirconium and rhenium were investigated. One Al–Mo–Cr and two Al–Mo alloys were studied. The ingots were smelted, rolled into sheets, and some had argon arc welded joints. The base material was tested for strength, elongation, and bending angle. The welded joints were tested for strength and banding angle of the seam metal. It was concluded that additives of 0.1–1.0% Zr and 0.2% Re increase the plasticity of the alloy sheets and joints. N.E.N.

N67-12659# Joint Publications Research Service, Washington, D. C.

INCREASING THE STRENGTH OF VT15 TITANIUM ALLOY CONTAINERS BY LOW-TEMPERATURE THERMO-MECHANICAL TREATMENT

A. I. Khorev and A. A. Livanov *In its* Soviet Res. on Titanium Alloys 28 Oct. 1966 p 21–25 Transl. into ENGLISH from Vestn. Mashinostr. (Moscow), no. 8, Aug. 1966 p 64–65 (See N67-12656 03-17) CFSTI: $2.00

The procedures of the deformation treatment by cold rolling are outlined, and the test data on strength and plasticity are presented. An increase of the extent of cold deformation resulted in increased strength of the containers, but plasticity was reduced. The rupture stress/strength relation was changed from 1.06 to 1.39 for the cold deformed containers. The properties of the containers tested after artificially aging are also tabulated. It was concluded that low temperature thermomechanical treatment with the optimal combination of 30%–50% deformation in a cold state permits the forming of cylindrical containers with a strength of up to 150–160 kg/mm^2. N.E.N.

N67-12673# Massachusetts Inst. of Tech., Cambridge. Metals Processing Lab.

DEFORMATION PROCESSING OF ANISOTROPIC METALS Final Report, 1 Jul. 1965–30 Jun. 1966

W. A. Backofen, D. L. Holt, D. Lee, P. Martin, and F. J. Azzarto Jul. 1966 100 p refs

(Contract NOw-66-0068-d)

(AD-639314) CFSTI: HC $3.00/MF $0.75

CONTENTS:

1. SUPERPLASTICITY IN THE Al-Cu EUTECTIC ALLOY D. L. Holt and W. A. Backofen 31 p refs (See N67-12674 03-17)

2. SUPERPLASTICITY IN SOME TITANIUM AND ZIRCONIUM ALLOYS D. Lee and W. A. Backofen 28 p refs (See N67-12675 03-17)

3. SUPERPLASTICITY IN ELECTROPLATED COMPOSITES OF LEAD AND TIN P. J. Martin and W. A. Backofen 28 p refs (See N67-12676 03-17)

4. SUPERPLASTICITY IN PELLET- AND INGOT-EXTRUSIONS OF THE MAGNESIUM ALLOY ZK60 F. J. Azzarto and W. A. Backofen 7 p (See N67-12677 03-17)

N67-12674# Massachusetts Inst. of Tech., Cambridge.

SUPERPLASTICITY IN THE Al–Cu EUTECTIC ALLOY

David L. Holt and Walter A. Backofen *In its* Deformation Process. of Anisotropic Metals Jul. 1966 31 p refs (See N67-12673 03-17) CFSTI: HC $3.00/MF $0.75

The tensile deformation of previously hot worked aluminum–copper eutectic alloy was experimentally investigated. At a temperature of 0.9 the absolute eutectic temperature, the index of strain-rate sensitivity (m) increased with strain rate from 0.3 to 0.7 before rate sensitivity decreased and the necking resistance was lost. The strain rate, ϵ_1, corresponding to peak m varied approximately as $1/L^2$, with L being the metallographic mean-free path. Below ϵ_1 at constant ϵ and T, the flow stress σ was proportional to the grain size L^p, with a ranging from 0.7 to 1.0. Grain boundary shear was proposed as the rate controlling process to account for this dependence of σ on L. To reconcile the experimental m vs ϵ relationship with boundary shear, it was also proposed that at low ϵ sliding resistance is governed largely by mechanical obstruction on the boundary forcing deformation into neighboring regions of the grain. But at higher ϵ the boundary becomes more mobile and smoother permitting greater contribution from the drag of a viscous boundary layer, and the strain-rate sensitivity is increased. Metallographic observations and other evidence of Bingham-type behavior with a strain dependent yield stress are interpreted in support of the proposal. L.S.

N67-12675# Massachusetts Inst. of Tech., Cambridge. Metals Processing Lab.
SUPERPLASTICITY IN SOME TITANIUM AND ZIRCONIUM ALLOYS
D. Lee and W. A. Backofen *In its* Deformation Process. of Anisotropic Metals Jul. 1966 28 p refs (See N67-12673 03-17) CFSTI: HC $3.00/MF $0.75

The condition of superplasticity or neck-resistant flow that is brought on by high strain-rate sensitivity has been observed in isothermal tension tests on several titanium alloys and one of zirconium. In general it was associated with reasonably fine-grain microstructures being strained in the transformation range at rates below $\epsilon \approx 10^{-3}\text{sec}^{-1}$. The metallographic mean-free path, L was measured at room temperature after rapid cooling from the temperature of testing. The flow stress of Ti-6Al-4V at 950°C was proportional to L^a at different constant ϵ; the value of a decreased with increasing ϵ, but at $\epsilon < 1.5 \times 10^{-4}\text{sec}^{-1}$ it varied only from 0.9 to 1.25. The findings were interpreted to mean that viscous boundary shear is the rate controlling process of deformation at high levels of strain rate sensitivity in these materials. Author

N67-12676# Massachusetts Inst. of Tech., Cambridge. Metals Processing Lab.
SUPERPLASTICITY IN ELECTROPLATED COMPOSITES OF LEAD AND TIN
P. J. Martin and W. A. Backofen *In its* Deformation Process. of Anisotropic Metals Jul. 1966 26 p refs (See N67-12673 03-17) CFSTI: HC $3.00/MF $0.75

Lead–tin composites were tested at room temperature after being prepared by electrodeposition in alternate layers of 0.5 to 5-microns thickness. The so-called transition strain-rate which roughly separates more conventional behavior from the superplasticity at lower strain rates was a strong inverse function of grain size. In general, the materials of finer structure were the more superplastic. A Bingham-type behavior was also evident in the finding that rate sensitivity increased with strain rate below the transition level. The effect of annealing after plating was much like that of coarsening the grain size, even though the grain size was not changed. The response to annealing has been related to precipitation from the supersaturated lead-rich phase that is developed by heating the mixture of pure components. Author

N67-12677# Massachusetts Inst. of Tech., Cambridge.
SUPERPLASTICITY IN PELLET- AND INGOT-EXTRUSIONS OF THE MAGNESIUM ALLOY ZK60
F. J. Azzarto and W. A. Backofen *In* its Deformation Process. of Anisotropic Metals Jul. 1966 7 p (See N67-12673 03-17) CFSTI: HC $3.00/MF $0.75

A high strength magnesium alloy containing about 6% zinc and 1/2% ZR(ZK60) was obtained in extruded lengths prepared form both fine-grained pellets and from ingot stock. Tensile tests were conducted on two samples of each kind of material (with either pellet or ingot extrusion procesing history). Plots depicting the strain-rate dependency on the strain-rate sensitivity index in the alloy forms; the strain-rate relation to the temperature; and the strain-rate dependence at various tensile elongations, are given. L.S.

N67-12700# Reactor Group, United Kingdom Atomic Energy Authority, Culcheth (England).
AN ELECTRON MICROSCOPE INVESTIGATION OF THE HIGH-TEMPERATURE EMBRITTLEMENT OF IRRADIATED STAINLESS STEELS
G. J. C. Carpenter, H. F. Merrick, R. B. Nicholson (Cambridge Univ.), and A. F. Rowcliffe 1966 40 p refs
(TRG-1283(C)) CFSTI: HC $2.00/MF $0.50

An electron microscope investigation has been carried out on three 20Cr–25Ni austenitic stainless steels irradiated at 650°C and 750°C in a thermal nuetron flux and tensile tested at 750°C, and on an M316L austenitic stainless steel irradiated at 300°C in a fast neutron flux. It is observed that heterogeneous precipitation of bubbles occurs during irradiation at 650°C and that during irradiation at 750°C homogeneous precipitation occurs as well. This behavior, and the effects of post-irradiation annealing, are discussed in terms of the helium concentration and the vacancy concentration. It is shown that, during high-temperature straining, growth of grain boundary bubbles occurs, and that the bubble spacing and the shape of the grain boundary cracks obtained support the theory that embrittlement is due to the linking up of bubbles which have exceeded the critical size for continuous growth. Author

N67-12810# Joint Publications Research Service, Washington, D. C.
STEEL CASTING AND FOUNDRY WORK IN THE USSR
9 Nov. 1966 39 p Transl. into ENGLISH of the book "XVIII Vsesoyuznaya Konferentsiya Liteyshchikov" Moscow, Machine Building Press, 1966
(JPRS-38574; TT-66-34999) CFSTI: $2.00

CONTENTS:

1. INFLUENCE OF MODIFIERS ON PROPERTIES OF THE STEEL Kh25N20S2 N. S. Kreshchanovskiy et al p 1–9 (See N67-12811 03-17)
2. TECHNOLOGICAL AND ORGANIZATIONAL PRINCIPLES OF INTRODUCING EXOTHERMIC RISERS IN CAST STEEL-MAKING V. N. Vorontsov and B. L. Serdyukov p 10–14 (See N67-12812 03-17)
3. INVESTIGATION OF THE CASTING PROPERTIES OF VACUUM-MELTED, ALLOYED AUSTENITIC STEELS AND ALLOYS G. F. Stasyuk et al p 15–21 (See N67-12813 03-17)
4. DESIGN FEATURES AND TECHNOLOGY OF MANUFACTURING THIN-WALLED CASTINGS FROM STRUCTURAL WELDABLE HIGH-STRENGTH STEELS Ya. Ye. Chiviksin and D. R. Kononov p 22–27 (See N67-12814 03-15)
5. INVESTMENT CASTING OF Cr–Ni STEEL VANES M. P. Voronin et al p 28–32 (See N67-12815 03-15)

N67-12811# Joint Publications Research Service, Washington, D. C.
INFLUENCE OF MODIFIERS ON PROPERTIES OF THE STEEL KH25N20S2
N. S. Kreshchanovskiy et al *In its* Steel Casting and Foundry Work in the USSR 9 Nov. 1966 p 1–9 (See N67-12810 03-17) CFSTI: $2.00

The effects of additives on mechanical, heat–strength, and operating properties of the steel were investigated. The additives used were cerium, zirconium, calcium, magnesium, lithium, and boron. Details are given on the changes in desulfurization, hydrogen content, nonmetallic inclusions, macrostructure, creep, strength, and other mechanical properties. It was concluded that: (1) Modified steel contains less nonmetallic inclusions than unmodified steel. (2) Gas content is lower in modified steel. (3) Cerium promotes desulfurizing. (4) Cerium, magnesium, and zirconium lead to pulverization of macrostructure only when specific amounts of the elements are introduced. N.E.N.

N67-12812# Joint Publications Research Service, Washington, D. C.
TECHNOLOGICAL AND ORGANIZATIONAL PRINCIPLES OF INTRODUCING EXOTHERMIC RISERS IN CAST STEEL-MAKING

V. N. Vorontsov and B. L. Serdyukov *In its* Steel Casting and Foundry Work in the USSR 9 Nov. 1966 p 10–14 (See N67-12810 03-17) CFSTI: $2.00

The method of heating risers with exothermic mixtures, the mixture's properties, and the advantages from using exothermic risers are reviewed. Among the conclusions are: (1) The exothermic heating of risers is economically effective and relativsly simple (2) A preliminary treatment with aluminum powder, iron ore or scale, and sulfite-alcoholic vinasse improves quality. (3) The molten steel consumption is reduced. N.E.N.

N67-12813# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE CASTING PROPERTIES OF VACUUM-MELTED, ALLOYED AUSTENITIC STEELS AND ALLOYS

G. F. Stasyuk et al *In its* Steel Casting and Foundry Work in the USSR 9 Nov. 1966 p 15–21 (See N67-12810 03-17) CFSTI: $2.00

The effect of melting and teeming in vacuum on casting properties of complex alloys was investigated, emphasizing austenitic steel and a nickel-base alloy. It was found that the duration of crystals under vacuum was 20%–60% longer than under atmospheric conditions. An increase in fluidity of the steel and alloy was noted in the vacuum process. The gas content in vacuumed metal was determine to be several times greater than in alloys melted in an open furnace. No change was found in linear shrinkage, but a reduction in volumetric shrinkage was noted. N.E.N.

N67-12826# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

HYDROGEN SUPERSATURATION IN ZIRCONIUM AND ZIRCONIUM–2.6WT% NIOBIUM

D. E. Coates Jul. 1966 21 p refs
(AECL-2599) CFSTI: HC $1.00/MF $0.50

A study of pressure-composition-temperature (P-C-T) relationships for low concentrations of hydrogen in zirconium and zirconium-2.5wt% niobium has been made. The results show the α-solid solution exhibits a high degree of supersaturation on cooling from the α-solid solution region. The presence of niobium was found to enhance the degree of this supersaturation effect. Author

N67-12831# United Kingdom Atomic Energy Authority Risley (England).

THE LOW ENDURANCE FATIGUE BEHAVIOUR OF 20/25/NB STAINLESS STEEL AT 25, 650 AND 750°C

G. Sumner 1966 22 p refs
(TRG-1247(S)) CFSTI: HC $1.00/MF $0.50

The low endurance fatigue behaviour of 20% Cr/25% N/0.7% Nb stainless steel has been investigated at 25, 650 and 750°C. The results show the plastic strain range to be related to the endurance by the Coffin–Manson power law. The exponent increased with temperature. The fatigue fractures were found to involve both inter- and intrangular fracture paths. The endurance at 25°C depended on surface condition, an electropolished surface increasing the endurance by a factor of three over a machined surface. Experiments are described showing the fatigue damage to be initiated at, or just below, the free surface. The surface condition had little effect on the endurance at 650 and 750°C. The presence of precipitated carbon M_6C had no effect on the fatigue endurance or fracture at 650°C; carbon in solution reduced the endurance and promoted intergranular fracture. In common with many other annealed materials, the fatigue hardening saturated at an early stage; the saturation stress range has been shown to be related to the plastic strain range by a simple power law, the exponent of which is temperature dependent. There is evidence that the exponent is interrelated with the Coffin–Manson exponent. Author

N67-12859# Gt. Brit. Ministry of Aviation, London.

THE PAINTING OF NON-FERROUS METALS AND COATINGS OF NON-FERROUS METALS [DER ANSTRICH VON NICHTEISENMETTALEN UND UEBERZUEGEN AUS NICHTEISENMETTALEN]

K. A. Van Oeteren Oct. 1966 14 p refs Transl. into ENGLISH from Maschinenschaden (Berlin), v. 39, no. 1/2, 1966 p 17–22
(TIL/T-5687) CFSTI: HC $1.00/MF $0.50

General information is given on the nature of the basic surface to be painted, the effect of the construction and choice of materials on corrosion, as well as the application of the coats of paint. The special requirements of the various nonferrous metals are discussed with regard to the preliminary treatment of the basic surface and the choice of paints. An exhaustive treatment is given of zinc coatings, particularly by hot galvanization. Author

N67-12861# Los Alamos Scientific Lab., N. Mex.

THE POTENTIOMETRIC TITRATION OF CERIUM AND MANGANESE FOLLOWING SEPARATION FROM PLUTONIUM AND COBALT

R. G. Bryan and G. R. Waterbury 7 Jan. 1966 16 p refs
(Contract W-7405-ENG-36)
(LA-3402) CFSTI: HC $1.00/MF $0.50

Cerium in ternary alloys consisting of plutonium, cerium, and cobalt, and cerium and manganese in quarternary alloys consisting of plutonium, cerium, cobalt, and manganese are separated and then determined by potentiometric titration. In the analysis of the ternary alloy, the plutonium is separated by an anion exchange resin method, and the cerium, in the presence of cobalt, is oxidized with silver(II) to cerium(IV) which is titrated with iron(II) solution. The relative standard deviation is 0.3% for a single measurement of cerium. In the analysis of the quarternary alloy, plutonium is separated by the anion exchange resin method, and then cerium is separated from manganese and cobalt using mixed mineral acid-organic solvent eluant solutions and strongly basic anion exchange resin columns. Then the cerium and manganese are oxidized to cerium(IV) and manganese(VII), respectively, with silver(II) oxide, and each is titrated with iron(II) solution. The average cerium found in 52 solutions, corresponding to 11 to 36% cerium in quarternary alloys that also contain 50% plutonium, was 99.8% with a relative standard deviation of 0.4%. The average manganese in the quaternary alloys, was 100.0% with a relative standard deviation of 0.4%. For manganese concentrations of 3% or less, an established spectrophotometric method is recommended. High concentrations of aluminum, chromium, lanthanum, nickel, sodium, and vanadium interfere in the method. Author (NSA)

N67-12887# Technische Hogeschool, Eindhoven (Netherlands).

THE RELATIONSHIP BETWEN MICROSTRUCTURE AND MAGNETIC PROPERTIES OF ALNICO ALLOYS

Krijn Jacobus de Vos (Ph.D. Thesis) [1966] 127 p refs
CFSTI: HC $4.00/MF $0.75

The quality of alnico (aluminum–nickel–cobalt–iron) permanent magnetic alloys depends on the crystallographic character of the their optimum permanent magnetic state phases. The presence of rod-like particles, as previously revealed by electron microscopic studies, together with the results of torque measurements, support the theory that shape anisotropy is the main source of high coercivity. A decomposition process of the quasi-binary Fe–NiAl section of the ternary Fe-Ni-Al system revealed spinodal decomposition as well as nucleation and growth. Optimum coercivity was achieved by continuous cooling of alloys containing about 50 at.% Fe, 25 at.% Ni, Fe, 25.5% Ni, and 25 at.% Al; however alloys containing approximately 34 at.% Fe, 33 at.% Ni, and 33 at.% Al required quenching followed by tempering at about 700°C for optimum coercivity. G.G.

N67-12895# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
STRESS REORIENTATION OF HYDRIDES IN COLD-WORKED ZIRCONIUM-2.5% NIOBIUM PRESSURE TUBES
G. W. Parry Aug. 1966 22 p refs
(AECL-2624) CFSTI: HC $1.00/MF $0.50

The susceptibility of cold drawn Zr-2.5% Nb pressure tubes to reorientation of hydride precipitates during cooling under an applied stress has been investigated. It is concluded that little reorientation occurs at stresses up to 35,000 psi, and when it occurs its effect on tensile properties is small. The tests tend to confirm the conclusions of previous investigators, that a high concentration of basal poles parallel to the applied stress is necessary for reorientation of the hydrides. Author

N67-12942# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON ANISOTROPIC CREEP OF MATERIALS
O. V. Sosnin [1965] 7 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 4, 1966 p 160–163

The question of anisotropy resulting from previous technological heat treatment of light alloys is considered. Since it is necessary to take account of the real, and not average, properties of the material in analyzing the item, experimental results on the creep of a sheet metal sample are presented. It is shown that the material is orthotropic in the stress and temperature range under investigation. Equations are presented to describe the behavior of materials in steady-state creep under one-dimensional loading conditions. S.P.

N67-12945# Lockheed Missiles and Space Co., Palo Alto, Calif.
ESTIMATES OF THE INFLUENCE OF BENDING IN DETERMINING THE TENSILE STRENGTH OF BRITTLE MATERIALS
I. S. Maleuskas and I. Ia. Peras [1965] 6 p refs Transl. into ENGLISH from Tr. Akad. Nauk Litov. SSR (Moscow), Ser. B, v. 1, no. 44, 1966 p 167–172

The question of the influence of bending, which occurs because of noncoaxiality of the loading application, on determining the tensile strength of brittle materials is considered. A method of computing the testing errors, taking account of the stress distribution over the whole sample volume, is proposed. On the basis of the Weibull statistical theory of brittle strength, formulas are obtained for the analysis of the testing errors associated with the noncoaxiality of the loading application. Two of the major conclusions drawn were that materials with a high degree of inhomogeneity are less responsive to noncoaxiality of the loading application than are homogeneous materials, and that the sample shape substantially affects the magnitude of the error. Other conditions being equal, circular samples are less sensitive to the effect of bending than are rectangular samples. S.P.

N67-12955# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.
ELECTROREFINING OF TITANIUM-NITROGEN ALLOYS
Oliver Q. Leone and Dwright E. Couch 1966 15 p refs
(BM-RI-6878)

Electrorefining tests using titanium-nitrogen alloys as anode material showed that no significant quantity of nitrogen was transferred to the cathode deposit. The nitrogen of the anode remained in the scale, and the titanium-nitrogen alloy was anodically insoluble in the electrolyte when the nitrogen content was 11 weight-percent. Author

N67-13035# Naval Scientific Technical Information Center, London (England).
THE PROBLEMS OF PITTING IN AUSTENITIC Cr–Ni-STEELS
H. Graefen May 1966 22 p refs Transl. into ENGLISH from Metalloberflaeche (Munich), v. 13, no. 6, Jun. 1959 p 161–166
(NSTIC-TRANS-1305; NSTIC/06780/66; TT-66-62165; AD-638506) CFSTI: HC $1.00/MF $0.50

Investigations were made of corrosion by 'pitting' in various solutions–the effect of redox systems, oxygen and P_H value–construction of potential/time curves and voltage curves–the effect of nitrate additives–electrochemical properties of halogen ions–effects connected with the use of alloys–connection between 'pitting' corrosion and stress cracking corrosion. Author (TAB)

N67-13094*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF GROWTH PARAMETERS FOR REFRACTORY CARBIDE SINGLE CRYSTALS Quarterly Status Report, 1 Jun.–1 Sep. 1961
R. W. Bartlett 30 Sep. 1966 18 p
(Contract NASr-49(19); SRI Proj. FMU-4892)
(NASA-CR-79406; QSR-10; Rept.-10) CFSTI: HC $1.00/MF $0.50 CSCL 20B

During this reporting period the arc-Verneuil crystal growing furnace was operated using tantalum carbide, hafnium carbide, and mixtures of these carbide powders. None of the boules grown were single crystals throughout. Dense stoichiometric boules of hafnium carbide were grown in one atmosphere of argon. Some of these boules contained only a few grain boundaries, and single crystal sections were cut from one of these boules. The tantalum carbide boules were carbon-deficient but substantially free of Ta_2C. Boules grown with physical mixtures of hafnium carbide and tantalum carbide particles were nonhomogeneous. Carbon enrichment experiments employing solid state diffusion of carbon into tantalum carbide boule wafers were conducted. The orientation of grains in tantalum carbide boules was also studied using the Laue X-ray diffraction method. The primary difficulty preventing growth of acceptable single crystals of both refractory carbides is the elimination of grain boundaries during growth. Author

N67-13119*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
FAILURE MECHANISMS AND STATISTICAL ASPECT OF METAL FATIGUE Technical Progress Report, Nov. 1, 1964–Oct. 31, 1966
G. K. Korbacher 31 Oct. 1966 22 p refs
(Grant NGR-52-026-008)
(NASA-CR-80440) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Work progress on the following projects are summarized and commented upon: 1) Failure Mechanisms and Statistical Aspects of Metal Fatigue, 2) An Attempt to Correlate Statistical Endurance Data with Wood's H, F, and S Ranges, 3) The Effect of a Cold-Worked Surface Layer on Fatigue Life and Behavior, 4) The Effect of Grain Size on the Fatigue Mechanisms and Endurance Distributions, and 5) Investigation of Environmental effects on the Failure Mechanisms in Metal Fatigue. The first three projects can be considered as completed. Preliminary testing for the last two projects was successfully completed. Graphically depicted stress amplitude statistical data obtained in the above projects are presented. L.S.

N67-13125*# North American Aviation, Inc., Los Angeles, Calif.
INVESTIGATION OF LONG TERM EXPOSURE EFFECTS UNDER STRESS ON SUPERSONIC TRANSPORT STRUCTURAL MATERIALS Phase I Report, Jun. 1963–Jul. 1964
George Martin Jul. 1964 87 p refs
(Contract NASw-748)
(NASA-CR-80489; NA-64-758) CFSTI: HC $2.50/MF $0.75 CSCL 11F

The report covers the first phase of a 30,000 hours exposure test. Six materials—two titaniun alloys, two PH steels and two superalloys—were tested under stress in five environmental conditions comprising combinations of salt and braze coatings and constant and cyclic exposure at 650°F. Braze coated titanium alloys, salt coated titanium 8Al-1V-1Mo alloy and cyclically exposed AM 350 M steel were the only alloys subject to stress corrosion failure within the 15,000 hours exposure covered. In this period relative phase changes occurred in the titanium alloys without significant mechanical property changes and aging reactions occurred in both steels and the superalloys with appropriate mechanical property changes. A hypothesis for corrosion reactions on titanium alloys in salt environments has been developed. Author

N67-13150# Aeronautical Research Labs., Melbourne (Australia).
THE EFFECT OF MICROSTRESSES ON THE STRESS-CORROSION PROPERTIES OF THE ALUMINUM ALLOY D.T.D. 5044
G. A. Hawkes Nov. 1965 10p refs
(ARL/MET-30) CFSTI: HC$1.00/MF$0.50

Stress-corrosion data have been obtained from specimens cut in the long transverse direction from an aluminum alloy extrusion. The specimens were prepared for test in such a way as to provide examples with approximately zero residual macrostress and increasing levels of microstress. Results from the stress-corrosion tests show that the addition of microstresses arising from cold work has had no effect on the stress-corrosion properties of this alloy. Author

N67-13185*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DEVELOPMENT OF DISPERSION STRENGTHENED TANTALUM BASE ALLOY Quarterly Progress Report, 20 Nov. 1965–20 Feb. 1966
R. W. Buckman, Jr. and R. C. Goodspeed 20 Feb. 1966 47 p refs
(Contract NAS3-2542)
(NASA-CR-72020; WANL-PR-(Q)-010; QPR-9) CFSTI: HC $2.00/MF$0.50 CSCL 11F

Development of dispersion strengthened tantalum base alloys for use in advanced space power systems continued with the completion of a study of the effect of welding, aging, and oxygen contamination on the ductile-brittle transition of six alloys. The alloys evaluated included carbide, nitride, and carbonitride strengthened types, as well as two solid solution alloys. Further processing and more detailed evaluation of alloy ASTAR-811C (Ta-8W-1Re-0.7Hf-0.025C), a fabricable, creep resistant composition, was also carried out. Preliminary test results indicate that a carbonitride strengthened composition was resistant to lithium corrosion at 2000°F. Author

N67-13188*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
DEVELOPMENT AND EVALUATION OF MAGNETIC AND ELECTRICAL MATERIALS CAPABLE OF OPERATING IN THE 800° TO 1600°F TEMPERATURE RANGE Quarterly Report, 1 Sep.–30 Nov. 1965
P. E. Kueser et al Dec. 1965 267 p refs
(Contract NAS3-6465)
(NASA-CR-54357; WAED 66.11E; Rept.-65.52E; QR-4) CFSTI: HC$3.75/MF$1.25 CSCL 11F

Screening results conducted on martensitic alloys, using additions of tantalum plus tungsten and tantalum plus silicon to a base composition of iron–15% nickel–25% cobalt, indicate that these alloys show promise for meeting the desired creep stress (>60,000 psi at 0.4 percent creep strain), and magnetic saturation (>13 kilogauss) at 1100°F. No problem appears to exist in meeting the goal of a coercive force of less than 25 oersteds at 1200 to 1600°F in either the 27 cobalt–iron base or cobalt base compositions. Comparison of electrical data on boron nitride (boralloy), polycrystalline alumina (Lucalox), polycrystalline beryllia, and single-crystal alumina (Linde sapphire) show that pyrolytic boron nitride has significantly lower a-c losses, higher d-c resistance, and exhibits less change in capacitance with temperature than any other material investigated in the temperature range from room temperature to Ceramic outgassing studies indicated that the present firing cycles applied to a ceramic using a nitrogen-hydrogen atmosphere followed by the vacuum treatment which they undergo during brazing is sufficient for minimizing oxygen bearing outgassing products. Author

N67-13288# Commissariat a l Energie Atomique, Scaly (France). Centre d'Etudes Nucleaires.
ORIENTATIONAL RELATIONSHIPS BETWEEN PHASES IN THE γ—α TRANSFORMATIONS FOR URANIUM–MOLYBDENUM ALLOYS [RELATIONS D'ORIENTATION ENTRE PHASES DANS LES TRANFORMATIONS γ—α DES ALLIAGES URANIUM–MOLYBDENE]
Gilbert Brun (Ph.D. Thesis) Apr. 1966 77 p In FRENCH
(CEA-R-2973)

A crystallographic study was made of the γ to $\alpha + \gamma$ transformation in an alloy containing 3% by wt Mo using electronic micro-diffraction. The orientational relationships governing the germination of the α phase in the γ phase were found to be: $(111)\gamma \mid\mid (100)\alpha$, $(112)\gamma \mid\mid (010)\alpha$, and $(110)\gamma \mid\mid (001)\alpha$. By choosing a monoclinic lattice containing the same number of atoms as the orthorhombic lattic for defining the γ mother phase, the change in structure was explained by adding a homogeneous $(112)\gamma\ [111]\gamma$ shearing deformation to a heterogeneous deformation brought about by slipping of the atoms which are not situated at the nodes of this lattice. The identify of the orientation relationships γ/α and $\gamma/\alpha^{11}b$ and the loss of coherence γ/α as a function of temperature of of time lead to the conclusion that, in the range studied, the γ-to-α transformation begins with a martensitic process and continues by germination and growth. Author (NSA)

N67-13289# Atomic Energy Commission Research Establishment, Riso (Denmark).
DISPERSION-STRENGTHENED ALUMINUM PRODUCTS
Niels Hansen May 1966 26 p refs Presented at the 2d Intern. Powder Met. Conf., Stary Smokovec-Vysoke Tatry, Czech., 27–30 Sep. 1966
(RISO-113; CONF-66-0915-1)

Dispersion-strengthened Al products consist of Al and a dispersed phase, normally Al_2O_3, and only this combination of materials is considered here. These products can be manufactured from Al powder either covered with the natural layer of Al_2O_3, high-temperature oxidized, or blended with Al–Al_2O_3 powder. The structure of the products is to a great extent determined by the extrusion step, and the structural changes during this process, which are followed by transmission electron microscopy, are related to the changes in mechanical properties. The microstructure of the extruded Al–Al_2O_3 products consists of an oxide phase finely dispersed in Al, containing a substructure of small grains. The formation and characteristics of these grains are discussed. NSA

N67-13295# Canada. Dept. of Mines and Tech. Surveys, Ottawa.
EFFECT OF HEAT TREATMENT ON THE CORROSION BEHAVIOR OF TWO ZIRCONIUM-COPPER-MOLYBDENUM ALLOYS
C. F. Dixon and H. M. Skelly Mar. 1966 14p refs
(NP-16239; R-183)

The effect of heat treatment on the corrosion properties of Zr–1.0% Cu–1.5% Mo and Zr–0.5% Cu–0.5% Mo alloys was investigated. The heat treatment found to give optimum corrosion resistance in steam was, for the Zr–1.0% Cu–1.5% Mo alloy, 1000°C for one hr, water quench, followed by aging at 500°C for 32 hr; and, for the Zr–0.5% Cu–0.5% Mo alloy, 1000°C for one hr, water quench, then aging at 500°C for 24 hr. Over-aging of the alloys resulted in growth of the intermetallic-phase particles, which then caused cracking of the corrosion film. Preparation of Zr–3.0% Cu–4.5% Mo alloy, which contained a larger percentage of the intermetallic phase, made it possible to identify, by X-ray diffraction, that phase as being a cubic structure with a unit cell of 4.999 Å. Author (NSA)

N67-13332# Commissariat a l'Energie Atomique, Scalay (France). Centre d'Etudes Nucleaires.
$\beta \rightarrow \alpha$ ISOTHERMAL TRANSFORMATION IN PURE AND WEAKLY ALLOYED URANIUM [TRANSFORMATION ISOTHERME $\beta \rightarrow \alpha$ DANS L'URANIUM PUR ET FAIBLEMENT ALLIE]
Henru Aubert and Claude Lelong Mar. 1966 53 p refs In FRENCH
(CEA-R-2956)

The TTT diagrams describing the $\beta \rightarrow \alpha$ isothermal tranformation were made by isothermal dilatometry for pure U and 21 alloys containing Cr, Si, Mo, Fe, Al, and Zr. The thermal cycle preceding the isothermal step influences the decomposition kinetics at temperature corresponding to the eutectoid and martensitic mechanisms, but not in the range where the bainitic transformation occurs. The stability of the β phase decreases with the Cr, Mo, and Si concentration; it is affected differently for each of the three tranformation mechanisms. The ternary additions, even at very low concentration have a considerable effect on the stability. When the concentration decreases the martensitic mechanism is active at progressively higher temperature, diminishing to the point of disappearance the temperature range where the transformation is considered as being of the bainitic mode. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N67-12374# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMATION AND FUSING OF CRYSTALS OF GUTTA-PERCHA DURING OBSERVATION UNDER MICROSCOPE
G. Ye. Novikova *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 100–115 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

Microscopic observations and photographic recording methods describe the process of gutta-percha crystal formation and melting. The camera and camera microattachment are detailed, and the crystal structure is shown in photographs. The crystal growth rate in gutta-percha was also assessed. R.Li.

N67-12400 Army Electronics Labs., Fort Monmouth, N. J.
PROPERTIES OF ULTRAFINE GRAINED $BaTiO_3$ SUPER-PRESSED AT LOW TEMPERATURES
R. J. Brandmayr Aug. 1966 30 p refs
(ECOM-2719; AD-639226) CFSTI: HC $2.00/MF $0.50

High purity, ultra-fine-grained $BaTiO_3$ has been densified by 'squeezing' in a hexahedral press at pressures of 50 kilobars and temperatures in the range of 125 to 720 C. X-ray diffraction patterns of the pressed material indicate that strain and/or particle reduction have resulted from application of the pressure. Electrical data show that a wide range of dielectric constants were obtained for these bodies, depending on the pressing temperatures. The bodies showed a high degree of temperature stability of dielectric constant due to complete suppression of the Curie temperature. Samples having an ultra-fine grained (0.05 microns), uniform micro-structure have been obtained. Author (TAB)

N67-12455# Naval Applied Science Lab., Brooklyn, N. Y.
PHOSPHORUS COMPOUNDS ON SILICEOUS GLASS SURFACES: NATURE OF HYDROLYTIC STABILITY AND EFFECT ON RESIN INTERFACE Final Report
Malcom E. Schrader, Irving Lerner, and Leo Deutsch •25 Aug. 1966 25 p refs
(AD-638753) CFSTI: HC $1.00/MF $0.50

Radioactive diethyl phosphite deposited from solution on glass disks or cloth formed a three component film according to the following classification: (1) Water soluble at 25C, (2) water insoluble at 25C, (3) water insoluble at 100C. (1) is interpreted as physically adsorbed, (2) as chemisorbed through one surface Si-O-P link per molecule, and (3) as chemisorbed through multiple surface Si-O-P links per molecule. Evidence indicates that (1) participates in increasing the dry strength of epoxy laminates. Author (TAB)

N67-12483# Naval Civil Engineering Lab., Port Hueneme, Calif.
VOLATILE PHOTODEGRADATION PRODUCTS OF ORGANIC COATINGS
Peter J. Hearst Jul. 1966 38 p refs
(R-460; Y-F020-03-03-004) CFSTI: HC $2.00/MF $0.50

Various clear and pigmented vehicle films were irradiated in air with a mercury arc and a xenon arc. The volatile photodegradation products were identified by infrared spectroscopy. The coatings included alkyd, oil, vinyl-alkyd, vinyl copolymer, partially hydrolyzed vinyl copolymer, polyvinyl acetate, epoxy-amine, and epoxy-polyamide films. The major product from all films was carbon dioxide. Eleven other products or types of products were obtained, as well as some unidentified products. The addition of pigments decreased the yields of almost all the products. However, the yields of different products were affected in different degrees by pigmentation, and this difference may in part be related to the penetration of the light responsible for the production of each particular product. Author

N67-12991*# Boeing Co., Seattle, Wash. Aerospace Group.
IDENTIFYING OPTIMUM PARAMETERS OF HOT EXTRUSIONS Progress Report No. 10, 16 Jul.–18 Oct. 1966
18 Oct. 1966 41 p refs
(Contract NAS7-276)
(NASA-CR-80365; PR-10) CFSTI: HC $2.00/MF $0.50 CSCL 11B

The purpose of this program is to develop a technique for hot extruding MgO and to determine the effect of hot extrusion on MgO and other oxides bodies. Chemical polishing of extruded MgO was shown to generally not reduce strength if the specimens were first annealed. These results show that strength reduction by chemical polishing found on unannealed MgO extrusions was due to residual stresses. Strength of extruded MgO fractured parallel to the extrusion axis was shown to be about the same as the strength of hot pressed MgO; substantially less than for extruded MgO fractured perpendicular to the extrusion axis. This provides

strong support for the dislocation crack nucleation mechanism in MgO. Evidence of slip bands and internal fractures supporting this mechanism were also found. It was shown that there is an increasing incidence of surface fracture origins in extruded MgO at both elevated temperatures and room temperature after annealing or chemical polishing. This supports the concept of work hardening of surface MgO grains during grinding and sanding. Direct evidence of such hardening was found. Author

N67-13009*# Utah Univ., Salt Lake City. Coll. of Engineering.
FATIGUE FAILURE IN LINEARLY VISCOELASTIC MATERIALS
M. L. Williams, W. G. Knauss (Calif. Inst. of Tech.) and F. R. Wagner Jun. 1966 13 p refs Presented at the Fifth Ann. ICRPG Mech. Behavior Working Group Meeting, APL, 15–16 Nov. 1966
(Contract NGR-45-003-029; Grant NsG-172-60)
(NASA-CR-80378; UTEC-DO-66-036) CFSTI: HC $1.00/MF $0.50 CSCL 11J

The thermodynamic approach to the fracture of linearly viscoelastic materials is extended to include fatigue. The theoretical analysis of the growth of an internal spherical flaw due to a uniformly distributed, oscillatory input of displacement in the radial direction predicts a growth-rest type of flaw growth which depends upon the properties of the media and the loading frequency. Comparison of these results with experimental crack growth data for a precracked sheet specimen subjected to an oscillatory displacement input discloses a qualitative similarity in behavior. It is, therefore, believed that the analytical model employed is representative of real flaw behavior and that its study can reveal the main features of macroscopic flaw-growth. Author

N67-13099*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF THE THERMAL STERILIZATION PROCEDURE ON POLYMERIC PRODUCTS
S. H. Kalfayan and B. A. Campbell 15 Nov. 1966 120 p refs
(Contract NAS7-100)
(NASA-CR-80434; JPL-TR-32-973) CFSTI: HC $3.00/MF $0.75 CSCL 11I

The effects of thermal sterilization on approximately 160 polymeric products used on the Ranger and Mariner spacecrafts are discussed. After classification according to function, the products were first subjected to a preliminary screening program that consisted of a 36-hr exposure at 145°C in dry nitrogen, with a limited amount of testing; this program screened out products of low thermal stability. Those that met the preliminary thermal compatibility criteria were subjected to 3 subjected 3 cycles of 36-hr exposure at 145°C in dry nitrogen. More extensive testing was conducted in this phase of the program both before and after thermal exposure to determine changes in the physical mechanical, electrical and thermal properties of the products. A discussion of the criteria used to evaluate the products is presented, in addition to the specific compatibility ratings assigned to each product as a result of the tests. Author

N67-13110*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION AND COMPARATIVE ANALYSIS OF CONFORMAL COATING MATERIALS
10 Oct. 1966 30 p
(NASA-TM-X-59180; ESE-E-55) CFSTI: HC $2.00/MF $0.50 CSCL 11I

This report is a comparative analysis of castable polyurethane materials and thin film forming materials used as environmental protective coating. The castable polyurethanes were designed and primarily intended for potting and molding of cable terminations; however, more recently they have been used as conformal coating. The thin film forming materials are designed and developed specifically as environmental protective coatings. The materials were evaluated for conformance to a set of ideal coating requirements designed to eliminate production and performance problems. Results show that thin film materials conform more closely to the ideal requirements than do castable polyurethanes. The use of thin film forming materials for conformal coating will eliminate certain current production problems, will provide a higher degree of performance reliability, and will substantially reduce costs. Author

N67-13196*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF DECONTAMINATION, STERILIZATION, AND PRECONDITIONING TREATMENTS ON ENERGY-DISSIPATING PROPERTIES OF BALSA WOOD
E. C. Bernett 1 Nov. 1966 13 p refs
(Contract NAS7-100)
(NASA-CR-80518; JPL-TR-32-1022) CFSTI: HC $1.00/MF $0.50 CSCL 11L

The effects of various decontamination, sterilization, and preconditioning treatments on the energy-dissipating properties of balsa wood have been measured. There was found to be a wide scatter in the properties of as-received balsa wood. Treatments of 5 hr at 260°C or 500 hr at 125°C caused significant degradation of the specific energy. Decreases to approximately 60% of the as-received value were measured. Other treatments did not have a serious effect on the specific energy, but did cause linear-dimension changes and variations in crushing stress that could be undesirable in some impact-limiting applications. Restrictive selection criteria may have to be established for the use of balsa wood as an energy-dissipating material. Author

N67-13239*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
EXPERIMENTAL INVESTIGATION OF ULTRA-HIGH VACUUM ADHESION AS RELATED TO THE LUNAR SURFACE Quarterly Progress Report, 1 Jul.–30 Sep. 1966
J. A. Ryan 30 Sep. 1966 22 p ref
(Contract NAS7-307)
(NASA-CR-80585; QPR-9) CFSTI: HC $1.00/MF $0.50 CSCL 11B

Studies have been concerned with measurements of adhesion between various silicate minerals whose surfaces have been formed in ultra-high vacuum by cleavage. The adhesion force has been investigated as a function of time at and degree of vacuum. It has been found that in most cases vacuum cleavage produces considerable surface electrostatic charging. Also, indications were found that the normal silicate atomic bonding forces were contributing to the adhesion. In all cases, the magnitude of the adhesion was considerably greater than that found for air-formed surfaces. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N67-12432# Wisconsin Univ., Madison. Mathematics Research Center.
FIXED POINT THEOREMS FOR WEAKLY CONTINUOUS MAPPINGS
Djairo G. de Figueiredo May 1966 15 p refs
(Contract DA-11-022-ORD-2059)
(MRC-638; AD-638661) CFSTI: HC $1.00/MF $0.50

A fixed point theorem for weakly continuous maps in Banach spaces is stated and proved. Author (TAB)

N67-12433# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SELECTION AND RANKING PROCEDURES AND ORDER STATISTICS FROM THE MULTINOMIAL DISTRIBUTION
Shanti S. Gupta and Klaus Nagel Jun. 1966 66 p refs *Its* Mimeograph Ser. no. 77
(Contract AF 33(657)-11737)
(AD-635619) CFSTI: HC $3.00/MF $0.75

The main problem defines a selection rule which determines a small, nonempty subset such that the probability of including the cell with the largest cell-probability is at least equal to a preassigned number. The procedures proposed depend on the largest or the smallest order statistic in a multinomial sample and hence the first two moments of these order statistics are evaluated. The selection rule for the maximum cell probability case is described, and the infimum of the probability of a correct selection is discussed. It is shown that the infimum takes place for configurations of the type (0,0,...,0,q,p,...,p) where $q \leq p$ and the number of zeros in the configuration is not known. A selection rule for the minimum cell probability case is proposed, and its efficiency is studied by deriving appropriate expressions for the expected proportion. The infimum of the probability of a correct selection is investigated and from the numerical evaluations it appears that the minimum takes place when all cell probabilities are equal. The order statistics of the multinomial distributions are discussed, and formulas for the first and second moments of the largest and smallest are given. C.T.C.

N67-12438# Wisconsin Univ., Madison. Mathematics Research Center.
STATISTICAL INFERENCE IN THE CLASSICAL OCCUPANCY PROBLEM--I Technical Summary Report
Bernard Harris Apr. 1966 22 p refs
(Contract DA-11-022-ORD-2059)
(MRC-639; AD-638660) CFSTI: HC $1.00/MF $0.50

The paper discusses the unbiased estimation of the number of classes in the classical occupancy problem and provides some asymptotic results. Author (TAB)

N67-12439# Wisconsin Univ., Madison. Mathematics Research Center.
AN ANALOG OF THE PROCESS OF TANGENT HYPERBOLAS FOR GENERAL FUNCTIONAL EQUATIONS Technical Summary Report
M. A. Mertvecova Mar. 1966 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 88, 1953 p 611-614
(Contract DA-11-022-ORD-2059)
(MRC-647; TT-66-62193; AD-638625) CFSTI: HC $1.00/MF $0.50

An iterative process with a cubic rate of convergence is developed for solving nonlinear operator equations in Banach spaces. Author (TAB)

N67-12503# Joint Publications Research Service, Washington, D. C.
METHODS OF SEQUENTIAL ANALYSIS IN PROBLEMS OF RECOGNITION OF MANY HYPOTHESES
Z. M. Benenson and E. M. Khazen *In its* Tech. Cybernetics, no. 4, 1966 16 Nov. 1966 p 17-37 refs (See N67-12501 03-10) CFSTI: $6.00

Problems are investigated considering the discrimination of many hypotheses and discrimination of hypotheses for incompletely known laws of distribution. A unit construction of the sequential decision rules is assumed for the investigated problems. The sequential procedure here consists in construction of some function (some statistic) $L(x_1, \ldots, x_m)$ of the observed values of $x_1, \ldots, x_m$ in comparison with the thresholds: the thresholds in the general case turn out to be variable depending on the observation time or on the number of observations made. The optimal threshold variables are determined with the help of a recurrent expression for the conditional risk function. For the selection of the statistic L restrictions are considered on the required memory size. The sequential rules obtained permit comparatively simple realization. Author

N67-12535# Wisconsin Univ., Madison. Mathematics Research Center.
ON ITERATIVE SOLUTIONS FOR QUANTUM-MECHANICAL MECHANICAL BOUND STATES
Peter D. Robinson Jan. 1966 34 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-609; AD-630542) CFSTI: HC $2.00/MF $0.50

Integral forms of Schrodinger's time-independent wave equation are considered, both in coordinate space (using free-particle Green's Functions) and in momentum space. Iterative solutions for bound states are investigated. Previous work is briefly discussed, and possibilities for future progress mentioned. Author (TAB)

N67-12644# Wisconsin Univ., Madison. Mathematics Research Center.
DUALITY FOR NONLINEAR PROGRAMMING IN A BANACH SPACE Technical Summary Report
K. Ritter Mar. 1966 20 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-627; AD-638650) CFSTI: HC $1.00/MF $0.50

The duality problem for nonlinear programming is considered in a real Banach space. Using an appropriate generalization of the Kuhn-Tucker Theorem the main results of the finite dimensional duality problem are extended to the infite dimensional case. It is shown that the dual problem of a quadratic infinite dimensional maximization problem can be transformed into a finite minimization problem in a finite dimensional Euclidean space. Potential applications to continuous programming problems and problems of optimal control theory are illustrated by an example. Author (TAB)

N67-12889# Department of Forestry, Vancouver (British Columbia).
PROBLEMS IN MULTIPLE REGRESSION ANALYSIS
A. Kozak [1966] 8 p
CFSTI: HC $1.00/MF $0.50

Investigated were the relative reliabilities of several methods to eliminate unimportant independent variables from problems in multiple regression analysis. Two sets of data were analyzed to demonstrate the danger when only a single elimination or building up procedure is used to define the variables included in the final estimating equation. Data set #1 contains one dependent and six independent variables with 108 observations; data set #2 has one dependent and eight independent variables with 168 observations. Three elimination and two building up methods were used to analyze the first group, and group number two was studied by the same methods with exception of number 4 which builds up the equation by a stepwise process, instead of eliminating the variables from a given equation. The order of elimination or inclusion of variables was different for each selected method. Obtained results showed that correlated independent variables might confuse the order of elimination and that a logic review of the variables was essential. If an important variable was eliminated from the equation, a review of the simple correlation coefficient matrix indicated the reason. G.G.

N67-12907*# Volt Technical Corp., Washington, D. C.
REPRESENTATION OF SPINORS IN THE N-DIMENSIONAL SPACE BY A SYSTEM OF TENSORS
V. A. Zhelnorovich 5 Oct. 1966 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Mat. (USSR), v. 169, no. 2, 1966 p 255-258
(Contract NAS5-12487)
(NASA-CR-80146; ST-MAT-10523) CFSTI: HC $1.00/MF $0.50
CSCL 12A

A complex tensor system and a system of real tensors are used in representing spinors in an n-dimensional space. Basic determinations are given which include consideration of a four-dimensional complex euclidean space referred to an orthonormalized base. C.T.C.

N67-12941# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE SOLUTION OF BOUNDARY VALUE PROBLEMS WITH NATURAL BOUNDARY CONDITIONS
A. I. Vaindiner [1966] 9 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. Ser. Mat.-Mekhan. (Moscow), no. 3, 1966 p 110–118

A method is presented for solving boundary value problems with natural boundary conditions. The approach is based on the fact that for such problems the space H_A of functions on which the energy functional F achieves a minimum must not absolutely satisfy additional (smooth) boundary conditions. The bending of a rectangular plate by an arbitrary transverse loading with bending moments and transverse forces distributed arbitrarily along the edges of the plate is considered as an example. S.P.

N67-12951# California Univ., Berkeley. Operations Research Center.
ALLOCATIONS OF SERVICING PERIODS WHICH MINIMIZE AVERAGE DELAY FOR N TIME-SHARED TRAFFIC STREAMS
R. Rangarajan and R. M. Oliver Nov. 1966 14 p ref
(Contract NBS CST-136)
(ORC-66-38)

A generalized model is proposed for delays to vehicles at an intersection of two streams of road traffic for the purpose of studying the allocation of servicing periods. The deterministic model is warranted by its application to high-utilization time-shared computers and in maintenance of large numbers of customers by one service center. S.P.

N67-12987*# New Hampshire Univ., Durham. Dept. of Physics.
MAXIMUM LIKELIHOOD METHOD FOR FITTING A SUM OF EXPONENTIALS TO EXPERIMENTAL DATA
R. A. Beauregard [1965] 11 p ref
(Grants NGR-30-002-018; NGR-30-002-021)
(NASA-CR-80355) CFSTI: HC $1.00/MF $0.50 CSCL 12A

This paper describes a procedure for fitting a sum of exponentials to a set of experimental data points by the method of maximum likelihood as described by Grard. In particular, an iterative process is used to maximize the likelihood function. Part I describes how the likelihood function may be written when a normal distribution of deviations in the observed data is assumed. A brief description of the error matrix is given. Part II describes a modified computer program (Fortran) designed for the IBM 1620 and the IBM 360. A sample set of data to be fit by two exponentials is given along with the solution by the program described. Author

N67-13097*# Clemson Coll., S. C.
THE EXISTENCE OF CERTAIN LINEAR APPROXIMATIONS WITHIN A TCHEBYCHEFF NORM
John W. Kenelly Nov. 1966 19 p refs
(Contract NAS8-11259)
(NASA-CR-61156) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Background is supplied and a theorem is proved that gives the existence of a linear approximation of a real valued function, defined on Euclidean n-space, by a class of functions within a Tchebycheff norm. The hypotheses of the theorem do not require any special conditions on the characteristics of the domain, the basic approximation functions, or the approximation bounds associated with any point of the domain. Author

N67-13140# New York Univ., N. Y.
THE STABILITY BEHAVIOR OF THE SOLUTIONS OF HAMILTONIAN SYSTEMS
J. Moser [1964] 40 p refs

Conservative systems for describing planetary orbits are considered, and equations are presented for the solution for long time intervals. The system of equations of the Hamilton canonical form is treated first in a discussion of existence and nonexistence of integrals. Then a statement of Kolmogorov's theorem and the annulus theorem is given. The periodic solutions of Hamiltonian systems are applied to the motion of a satellite about an oblate earth, and proof of the theorem on annulus mapping is presented. S.P.

N67-13158# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
A SURVEY OF THE THEORETICAL BEHAVIOUR OF QUEUES
W. N. Miller 1966 72 p refs
(TRG-1153(S)) HMSO: 9s

Equations are given from which the various properties of a queue with one or more servers, random arrivals and exponential service times may be obtained. A single-server queue with priorities is studied. General queue disciplines are discussed and, in particular, equations are derived for queue properties where there is random selection for service. Only equilibrium queueing conditions are considered in this report. The possibilities of employing simulation techniques for non-equilibrium conditions are discussed briefly. A synopsis of the report in non-mathematical terms is included. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N67-12481# Chicago Univ., Ill. Cloud Physics Lab.
RAIN PHYSICS RESEARCH, APRIL 1965–APRIL 1966
Roscoe R. Braham, Jr. Aug. 1966 92 p refs
(Grant NSF GP-3779)

CONTENTS:

1. CIRRUS CRYSTALS IN CLEAR AIR R. R. Braham, Jr. and P. Spyers-Duran p 16–18 (See N67-12482 03-20)
2. STATISTICAL ANALYSIS OF THE PRECIPITATION DATA OF PROJECT WHITETOP J. Fluck p 19–42 refs (See N67-12483 03-20)
3. ANALYSIS OF PHOTOGRAMMETRIC CLOUD MEASUREMENTS E. L. Harrington p 43–55 refs (See N67-12484 03-20)
4. PRECIPITATION PARTICLE DISTRIBUTIONS R. Lyons p 56–65 refs (See N67-12485 03-20)
5. AN AIRBORNE CONTINUOUS CLOUD PARTICLE REPLICATOR P. Spyers-Duran p 66–75 refs (See N67-12486 03-14)
6. A TECHNIQUE FOR SECTIONING SNOW PELLETS P. Spyers-Duran p 76–79 refs (See N67-12487 03-20)

N67-12482# Chicago Univ., Ill. Cloud Physics Lab.
CIRRUS CRYSTALS IN CLEAR AIR
Roscoe R. Braham, Jr. and Paul Spyers-Duran *In its* Rain Phys. Res., Apr. 1965–Apr. 1966 Aug. 1966 p 16–18 (See N67-12481 03-20)

A series of flights were conducted using an instrumented cloud physics aircraft for collecting crystals far below the cirrus formation levels. Equipped to measure several cloud and clean air

parameters, the aircraft contains a cloud particle replicator which operates on the principle of encapsulating cloud particles in a continuously moving ribbon of Formvar plastic. Collections were made using two different types of flights: (1) flights at −10° and −15°C in clear air beneath visual cirrus clouds, and (2) flights around and through tops of small altocumulus, stratocumulus, and cumulus mediocris which were inversion limited at temperatures of about −5°C. After returning to the ground the replicator tapes were examined for size, shape, and concentration of any crystals collected. On every flight beneath visual cirrus, ice particles were found on the continuous replicator. N.A.S.

N67-12483# Chicago Univ., Ill. Cloud Physics Lab.
STATISTICAL ANALYSIS OF THE PRECIPITATION DATA OF PROJECT WHITETOP
John Flueck *In its* Rain Phys. Res., Apr. 1965–Apr. 1966 Aug. 1966 p 19–42 refs (See N67-12481 03-20)

The various approaches being taken in analyzing the data from the five-year randomized seeding project are discussed, and the problems encountered in preparing and reducing this information are assessed. Three general data categories are considered: Missouri plume rainfall, Chicago plume rainfall, and Chicago plume echo cover. The necessity for a systematic and thorough check of basic precipitation data from the echo cover and rain gauge netowrk is pointed out, and the underlying assumptions which the statistician can invoke are examined in relation to their influence on the types of analyses. To determine the possible population distributional forms for the plume (P), nonplume (NP), and the P-NP variables, the five-year daily averages for seeded and not-seeded days were graphed. Nonparametric analyses were conducted by considering each year's data separately, and then pooling the yearly results. Rank correlations of daily averages between P and NP were drawn, and the similarities and differences noted in the parametric tests of the seeding effect are discussed. N.A.S.

N67-12484# Chicago Univ., Ill. Cloud Physics Lab.
ANALYSIS OF PHOTOGRAMMETIC CLOUD MEASUREMENTS
Edward L. Harrington *In its* Rain Phys. Res., Apr. 1965–Apr. 1966 Aug. 1966 p 43–55 refs (See N67-12481 03-20)

To obtain cloud height and distance measurements, aerial cameras were rigidly mounted in pairs with the camera axes horizontal, parallel, and perpendicular to the line joining them; one camera mounted adjacent to a radar facility permits examination of the clouds which appear in the stereoscopic pair of photographs. Selection of cumulus clouds for measurement was based on the ability to determine the cloud top height and its horizontal position at the time when a precipitation echo was initiated within it. Measurement data on 43 clouds which did not develop echo are summarized. It is pointed out that where variability of cloud base height occurs, cloud depth is a more dependable cloud census statistic than cloud top height. Data are also tabulated on 10 clouds which developed first echoes while being photographed. Indications are that convective clouds most frequently initiate precipitation by an all-water process. Fifty percent of all first echoes measured were found to be entirely warmer than freezing, and another 40 percent straddled the freezing level. N.A.S.

N67-12485# Chicago Univ., Ill. Cloud Physics Lab.
PRECIPITATION PARTICLE DISTRIBUTIONS
Richard Lyons *In its* Rain Phys. Res., Apr. 1965–Apr. 1966 Aug. 1966 p 56–65 refs (See N67-12481 03-20)

Precipitation particle data obtained with an aircraft foil sampler from cumulus congestus clouds are being used to determine the variance in mean particle distribution as the cloud progresses through its life cycle; the association between these distributions and various cloud parameters; and the effect of the cloud's growth stage on the spatial fluctuations of the particle distribution. Mean particle distributions were obtained by averaging the concentrations by size class interval for cloud segments of approximately 1000 ft length. The data suggest that the distribution curve slopes are quite similar in the 250 to 750 micron range for all growth stages; while particles 450 microns or smaller contribute more than half to the total concentration. Studies were also conducted to find concentration variations along the cloud traverse and its association with cloud stage. Indications are that clouds in the growing stage have a concentration probability maximum near the center; for the mature stage probability maximum tends to occur near the edges. Clouds in the dissipating stage appear flat with regard to spatial distributions. M.G.J.

N67-12487# Chicago Univ., Ill. Cloud Physics Lab.
A TECHNIQUE FOR SECTIONING SNOW PELLETS
Paul Spyers-Duran *In its* Rain Phys. Res., Apr. 1965–Apr. 1966 Aug. 1966 p 76–79 refs (See N67-12481 03-20)

To develop a technique for producing thin sections of small solid hydrometeors, samples of snow pellets in cumulus clouds were collected. This technique will be utilized to investigate whether a unique relationship exists between the pellet structure and the nature of its growth and how the initiation of the ice phase takes place in a supercooled convective cloud. A thin section technique used on small pellets is reviewed. It is pointed out that the final layer obtained is usually a few tenths of a millimeter thick. Photomicrograph examples are included of specimens examined under polarized light to show the arrangement of the crystalline structure and sizes of the individual crystals. N.A.S.

N67-12801# Joint Publications Research Service, Washington, D. C.
METEOROLOGY AND HYDROLOGY, NUMBER 9, 1966
23 Nov. 1966 82 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1966
(JPRS-38779; TT-66-35203) CFSTI: $3.00

CONTENTS:

1. THE CHARACTER OF THE RELATIONSHIP BETWEEN CHARACTERISTICS OF CIRCULATION IN THE LOWER STRATOSPHERE AND THE ONSET OF WINTER AND SPRING SEASONS IN THE TROPOSPHERE S. T. Pagava p 1–9 refs (See N67-12802 03-20)
2. RELATIONSHIP BETWEEN THE DISTRIBUTION OF ATMOSPHERIC OZONE AND SOME FORMS OF GENERAL CIRCULATION OF THE ATMOSPHERE A. Kh. Khrgian p 10–20 refs (See N67-12803 03-20)
3. SPATIAL MODEL OF FORECAST OF THE ATMOSPHERIC PRESSURE FIELD IN A QUASI-GEOSTROPHIC APPROXIMATION N. I. Buleyev, K. I. Vasil'yeva, and N. M. Kireyeva p 21–30 refs (See N67-12804 03-20)
4. SECULAR VARIATION OF ATMOSPHERIC DROUGHTS IN THE UKRAINE I. Ye. Buchinskiy p 31–37 refs (See N67-12805 03-20)
5. SOME RESULTS OF ANALYSIS OF DRIFT OF RADIOBEACONS AND DRIFTING AUTOMATIC RADIOMETEOROLOGICAL STATIONS IN THE ARCTIC OCEAN A. I. Yurokin and Yu. N. Sinyurin p 38–43 (See N67-12806 03-13) N67-12806 03-13)
6. A NEW TYPE OF THERMOBALANCOGRAPH AND RESULTS OF ITS TESTS UNDER FIELD CONDITIONS N. A. Yefimova and M. G. Sanoyan p 44–51 refs (See N67-12807 03-14)
7. NEW SOVIET BOOKS ON METEOROLOGY p 52–56
8. GOVERNMENT AWARDS TO SOVIET METEOROLOGISTS p 57
9. NEWS OF THE MAIN ADMINISTRATION OF THE HYDROMETEOROLOGICAL SERVICE p 58–60
10. NEWS OF THE INSTITUTES OF THE HYDROMETEOROLOGICAL SERVICE p 61–63
11. HYDROMETEOROLOGICAL CONFERENCES IN THE USSR p 64–67

12. FOREIGN METEOROLOGICAL NEWS PUBLISHED IN SOVIET PRESS p 68–70
13. NOTES ON THE WORLD METEOROLOGICAL ORGANIZATION p 71–72
14. ANTARCTIC NOTES p 73

N67-12802# Joint Publications Research Service, Washington, D. C.

THE CHARACTER OF THE RELATIONSHIP BETWEEN CHARACTERISTICS OF CIRCULATION IN THE LOWER STRATOSPHERE AND THE ONSET OF WINTER AND SPRING SEASONS IN THE TROPOSPHERE

S. T. Pagava *In its* Meteorol. and Hydrol., No. 9, 1966 23 Nov. 1966 p 1–9 refs (See N67-12801 03-20) CFSTI: $3.00

An analysis of seasonal characteristics of atmospheric circulation in winter and spring, and an analysis of the seasonal changes of the geopotential and temperature fields in the northern hemisphere at the 100-mb surface over a period of ten half-years are presented. The beginnings and endings of the various characteristics, and the relationship of activities in the lower stratosphere and the troposphere are discussed. It is concluded that a precursor of the natural synoptic season of spring in the troposphere for the first natural synoptic region is the onset of a period of destruction of the vortex in the lower stratosphere. It is suggested that a knowledge of these relationships facilitates seasonal weather forecasts by the synoptic method. N.E.N.

N67-12803# Joint Publications Research Service, Washington, D. C.

RELATIONSHIP BETWEEN THE DISTRIBUTION OF ATMOSPHERIC OZONE AND SOME FORMS OF GENERAL CIRCULATION OF THE ATMOSPHERE

A. Kh. Khrgian *In its* Meteorol. and Hydrol., No. 9, 1966 23 Nov. 1966 p 10–20 refs (See N67-12801 03-20) CFSTI: $3.00

The ozone balance in the stratospheric streams, and the determination of air currents are investigated. Vertical distributions of ozone are presented, and their relation to photochemical equilibrium and turbulence are discussed. Calculations were made of the of the total quantity of ozone from the mean as a function of the longitudinal distance from the axis of the trough of long waves in the free atmosphere at the 100-mb level. The calculations were found to agree with the theory that if there is a general descending current the ozonized air will descend and the air taking its place will soon be rich in ozone, and that this is related to the vertical movement in long waves of a cyclone. N.E.N.

N67-12804# Joint Publications Research Service, Washington, D. C.

SPATIAL MODEL OF FORECAST OF THE ATMOSPHERIC PRESSURE FIELD IN A QUASI-GEOSTROPHIC APPROXIMATION

N. I. Buleyev, K. I. Vasil'yeva, and N. M. Kireyeva *In its* Meteorol. and Hydrol., No. 9, 1966 23 Nov. 1966 p 21–30 refs (See N67-12801 03-20) CFSTI: $3.00

A multilevel mathematical model of forecasting based on the direct solution of the initial equations of dynamics in a quasi-geostrophic approximation by the finite difference method is presented. Examples of forecasts are given, and the correlation coefficients of the computed and actual pressure changes at the 900-, 500-, and 300-mb levels are tabulated. Maps of the predicted and actual pressure fields at the 700- and 300-mb levels are included. It was concluded that the predicted and actual measurements were in good agreement, and that the method forecasts the isobaric surface at 300-mb better than for 900- and 700-mb surfaces. N.E.N.

N67-12805# Joint Publications Research Service, Washington, D. C.

SECULAR VARIATION OF ATMOSPHERIC DROUGHTS IN THE UKRAINE

I. Ye. Buchinskiy *In its* Meteorol. and Hydrol., No. 9, 1966 23 Nov. 1966 p 31–37 refs (See N67-12801 03-20) CFSTI: $3.00

A climatic investigation of droughts, including the territory subjected and the degree of aridity, is presented. The criteria of aridity and pluviothermal coefficients are discussed. Data for the period 1871–1965 are graphed for spring, summer, and autumn, and for the entire warm season. A cyclic character of fluctuations was noted, and a period of 22 years for the entire warm season was found. N.E.N.

N67-12966# Allied Research Associates, Inc., Concord, Mass.

THE NIMBUS II DATA CATALOG, VOLUME I, 15 MAY–30 JUNE 1966

Jul. 1966 441 p

(NASA-CR-80342) CFSTI: HC $7.41/MF $2.00 CSCL 04B

Presented are meteorological and geomorphological data acquired from the Nimbus II satellite during the period May 20 through June 30, 1966. Covered are data from the (1) Advanced Vidicon Camera System; (2) High Resolution Infrared Radiometer; (3) Medium Resolution Infrared Radiometer; (4) Automatic Picture Transmission operation; and (5) Direct Readout Infrared Radiometer operation. Also contained are catalog anomalies, orbital data, and data from the Sensory Information Processing program. A data extraction is provided to facilitate a search and retrieval capability by subject, yielding certain types of peripheral information required to support further analysis. K.W.

N67-12974*# Chicago Univ., Ill. Dept. of the Geophysical Sciences.

PRELIMINARY INVESTIGATION OF PERIPHERAL SUBSIDENCE ASSOCIATED WITH HURRICANE OUTFLOW

Ronald M. Reap Jul. 1966 22 p refs

(Grant NsG-333)

(NASA-CR-80333; SMRP-63) CFSTI: HC $1.00/MF $0.50 CSCL 04B

Synoptic and Nimbus I High Resolution Infrared Radiometer (HRIR) data were utilized to determine the vertical temperature, moisture, and cloud distribution within the peripheral divergence area associated with Hurricane Dora. Relationships between the 200 mb shear line, high-level storm outflow, low-level drying and outer convective cloud bands were examined for the period September 8–10, 1964. A zone of low-level cloud suppression, characterized by marked drying and relative warming aloft, was observed 25–100 nautical miles east of the upper shear line. Convective cloud bands were located along the sharp horizontal moisture gradients bordering the zone of pronounced drying. The principle of vertical coupling was proposed as an explanation for the slowly changing structure of temperature, moisture and cloudiness observed relative to the moving 200 mb shear line. Author

N67-13021# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

06301 LANCE MISSILE NO. 050, ROUND NO. 026 (27 JULY 1966) Meteorological Data Report

Aug. 1966 30 p

(DR-67; AD-487463)

Meteorological data gathered for the launching of 06301 Lance, Missile Number 050, Round Number 026 RML, are presented in tabular form. Author (TAB)

N67-13022*# Allied Research Associates, Inc., Concord, Mass.

THE NIMBUS II DATA CATALOG, VOLUME 2, 1 JULY–31 JULY 1966

Greenbelt, Md., NASA. Goddard Space Flight Center, Aug. 1966 298 p
(NASA-TM-X-59176) CFSTI: HC$6.00/MF$1.25 CSCL 04B

Meteorological and geomorphological data tabulations from Nimbus satellite observations are presented that were received during July, 1966. The satellite carried an advanced vidicon camera system and a high resolution infrared radiometer detector cell. Ascending nodes and orbit numbers are shown on each map representing daytime data; descending nodes are shown on maps which contain nighttime data. A data extract is also provided for search and retrieval capability by subject. G.G.

N67-13028# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
NIKE–APACHE SPEEDBALL II, ROUND NO. 87 SN 33 (3 AUGUST 1966) Meteorological Data Report
Len E. Carter Sep. 1966 18 p
(DR-72; AD-638722) CFSTI: HC$1.00/MF$0.50

Meteorological data gathered for the launching of Nike-Apache Speedball II, round number 87, sn 33, are presented for the Physical Sciences Laboratory of New Mexico State University, the U. S. Naval Research Laboratory, and for future ballistic studies. The meteorological data and resulting ballistic data appear in tabular form. Author (TAB)

N67-13037# Inter-Range Instrumentation Group, White Sands Missile Range, N. Mex.
METEOROLOGICAL ROCKET NETWORK FIRINGS. VOLUME LII: DECEMBER 1965 FIRINGS
May 1966 87 p
(IRIG-109-62, Vol. LII; AD-487486)

The Meteorological Rocket Network Data Reports contain the wind and temperature measurements from all available Network firings for that particular month, along with computed values for pressure, density, and speed of sound. A brief monthly summary is initiated with the 1965 data reports. This summary is designed to compare the mean profile for the current month with long-term means for the same month. TAB

N67-13040# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE AF 3.525 (22 JULY 1966) Meteorological Data Report
Marjorie Mc Lardie Hoidale Aug. 1966 24 p refs
(DR-66; AD-487462)

Meteorological data gathered for the launching of Aerobee AF 3.525 are presented for the Air Force Cambridge Research Laboratories and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author (TAB)

N67-13115# Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
AN ATTEMPT TO USE SATELLITE PHOTOGRAPHY IN NUMERICAL WEATHER PREDICTION
James H. S. Bradley, Christopher M. Hayden, and Aksel C. Wiin-Nielsen Jun. 1966 86 p refs
(Contract CwB-11145)
(Rept.-07424-1-T)

Tiros photographs were used for barotropic reanalysis in the Pacific, changes in the stream function or its Laplacian being advected into areas whith verification data by the NMC barotropic model. No significant forecast improvement was obtained in cases of unusually bad forecasts, despite experiments in varying the intensity of the reanalyzed systems. No continuity or radiation data were available. The estimation of winds and vorticities is difficult. Hindcast-reforecast procedures, indicate that the main causes of error in unusually bad forecasts are not susceptible to satellite correction, and the difficulties in the balance equation cause the stream field to contain many negative absolute vorticities not present in the geopotential analysis. The methods used would be more promising in cases with smaller forecast errors. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N67-12345# Joint Publications Research Service, Washington, D. C.
SIMULATION OF A MONITORING AND DECISION UNIT FOR A SHIP NAVIGATION SYSTEM
L. N. Al'perin *In its* Rept. on Soviet Res. in the Field of Bionics 21 Nov. 1966 p 17–22 refs (See N67-12341 03-05) CFSTI: $4.00

The decision-making process involved in navigating a ship is traced, and the process of orientation of man is considered in order to optimize and humanize the pilot link of the ship guidance system with the necessary level of reliability and to achieve optimal and efficient use of the appropriate techniques and equipment. It is pointed out that, for successful orientation, it is necessary to form a space–time image reflecting not only the spatial image of the locality but also the dynamics of the ship's motion. The process of orientation of the pilot is considered as various combinations of direct and inverse checking. On the basis of this, a structural-summation circuit is proposed for a ship guidance system monitoring decision block. L.E.W.

N67-12479# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Steuer- und Regeltechnik.
INSPECTION, MAINTENANCE AND REPAIR OF INERTIAL GUIDANCE SYSTEMS, PART I [PRUEFUNG, WARTUNG UNDER INSTANDSETZUNG VON TRAEGHEITSNAVIGATION SANLAGEN, TEIL I]
H. Kuenzner Jul. 1966 95p refs Presented at the DVL Symp., Munich, 14–15 Oct. 1963
(DLR-MITT.-66-09, Pt. I; DVL-373) CFSTI: HC$3.00/MF$0.75

A brief review of organization, mission requirements, and the support concept for special repair activities on inertial guidance systems at Newark Air Force Station is followed by a description of testing procedures on inertial quality gyroscopes in England. Very precise servo tests were performed by newly constructed test table resting on air bearing gyros. Block diagrams depict control and readout electronics for these navigational evaluation apparatures. G.G.

N67-12480# Deutsche Versuchsanstalt für Luft-und Raumfahrt, Munich (West Germany). Inst. fuer Steuer- und Regeltechnik.
INSPECTION, MAINTENANCE AND REPAIR OF INERTIAL GUIDANCE SYSTEMS, PART II [PRUEFUNG, WARTUNG UND INSTANDSETZUNG VON TRAEGHEITSNAVIGATION SANLAGEN, TEIL II]
H. Kuenzner Jul. 1966 108p refs In GERMAN Presented at the DVL Symp., Munich, 14–15 Oct. 1963
(DLR-MITT.-66-10, Pt. II; DVL-373) CFSTI: $4.00/MF$0.75

Papers in this report describe the evolution of laboratory tests for inertial guidance systems that identify problems, determine performance, and help design a system's accuracy. Considered are attitude motion simulators with symmetrical platforms. Special emphasis is placed on the Norden platform that gives an optimal azimuth gyrocompass response for all latitudes. G.G.

N67-12779# Joint Publications Research Service, Washington, D.C.
EFFECT OF HYPERSONIC SPEED ON THE ERRORS OF THE VERTICAL CHANNELS OF INERTIAL SYSTEMS
V. M. Shohepkine *In its* Izv. VUZov: Instr. Bldg., Vol. IX, No. 4 22 Nov. 1966 p 80–86 refs (See N67-12761 03-14) CFSTI: $5.00

The effect of hypersonic speed on errors made in determining the altitude of a moving object by using a navigational inertial system is discussed. It is shown that the magnitude of the errors is substantially affected by hypersonic speed, which also affects the character and their changes, depending on time. Author

N67-12832# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
MECHANICAL BASIS AND FORM OF THE APPLICATION OF NAVIGATION BY INERTIA [LES FONDEMENTS MECANIQUES ET LES FORMS D'APPLICATION DE LA NAVIGATION PAR INERTIE]
Pierre Contensou 1966 34 p refs In FRENCH Presented at the 1966 Session of the Maritime and Aeron. Assoc., Paris, 2–6 May 1966
(TP-352(1966)) CFSTI: HC $2.00/MF $0.50

The rational flight mechanics basis of inertial navigation in relation to the gravity field, and its application to ballistic missile technology are discussed. A series of equations is derived to show the principles of motion in inertial guidance, and the basic equation for inertial navigation is cited. The vector defining the estimated position, as applied to localization of ships and aircraft, is expressed mathematically. The precision of calculations, according to the shape of the gravity field, is stressed. Briefly mentioned also are angular navigation, and navigation on a known curve, a gravity field surface, and in relation to a non-Galilean point of reference. Transl. by R.Li.

N67-12964# Federal Avaiation Agency, Atlantic City, N. J. Test and Evaluation Div.
VORTAC ERROR ANALYSIS FOR HELICOPTER NAVIGATION, NEW YORK CITY AREA Final Report
Ronald Braff Sep. 1966 57 p refs
(RD-66-48)

A study of the precision and coverage provided by the present VORTAC system in the low altitude helicopter environment of metropolitan New York is reported. Pertinent radio propagation theory and navigation error theory are applied in estimating performance and comparing the DME/DME and DME/VOR systems with respect to their area coverage and their specific helicopter IFR route coverage. Author

N67-13156# Sperry Gyroscope Co., Ltd., Bracknell (England).
AUTOMATIC LANDING AND AUTOPILOTS
Nov. 1964 12 p refs

An annotated bibliography including articles published between October 1962 and November 1964 is given in the field of automatic landing and autopilots. An author index is included. L.E.W.

N67-13246*# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
ATC CONCEPTS FOR SUPERSONIC VEHICLES, PART I Final Report
Andrew L. Sluka Aug. 1966 68 p refs Sponsored in Part by NASA
(NASA-TM-X-59175; RD-66-62) CFSTI: HC $3.00/MF $0.75 CSCL 17G

Dynamic simulation studies are described which are a part of a joint Federal Aviation Agency (FAA) and National Aeronautic and Space Administration (NASA) simulation program to determine what impact the supersonic Transport (SST) will have on the Air Traffic Control (ATC) System, as well as the Air Traffic Control System impact on the supersonic transport operating characteristics. Actual performance and handling characteristics of a fixed and variable sweep supersonic transport configuration were simulated. Results showed that penalties in the form of delay and reduced operation rates were incurred by other air traffic in each system in which increased separation standards and high priority treatment were provided to the SSTs. Low priority treatment and present day separation standards offer the most acceptable compromise between rigid SST priority and the flexibility needed by the ATC system. Current Air Route Traffic Control Center sectors were found to be too small for efficient control of aircraft operating at supersonic speeds. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N67-12461# Aktiebolaget Atomenergi, Stockholm (Sweden).
OPERATING EXPERIENCE AT THE AGESTA NUCLEAR POWER STATION
S. Sandstroem, ed. Sep. 1966 126 p
(AE-248) CFSTI: HC $4.00/MF $0.75

CONTENTS

1. SUMMARY DESCRIPTION OF PLANT CIRCUITS K. Kull p 1–9 (See N67-12462 03-22)
2. AGESTA LOG N. Rydell and E. Ericsson p 10–18 (See N67-12463 03-22)
3. HEAVY WATER COMPONENTS A. Oestman p 19–28 (See N67-12464 03-22)
4. SPECIAL OPERATIONAL PROCEDURES I. Holtz p 29–37 (See N67-12465 03-22)
5. INSTRUMENTATION AND CONTROL I.Myren p 38–47 (See N67-12466 03-22)
6. FUEL AND CONTROL ROD HANDLING L. Brostroem p 48–55 (See N67-12467 03-22)
7. CHEMISTRY E. Linden p 56–65 (See N67-12468 03-22)
8. RADIATION HAZARDS B. Mandahl p 66–71 (See N67-12469 03-22)
9. ELECTRICAL INSTALLATIONS I. Wetterholm p 72–81 (See N67-12470 03-22)
10. REACTOR PHYSICS EXPERIMENTS G. Apelqvist and P. Blomberg p 82–107 (See N67-12471 03-22)

N67-12462# Aktiebolaget Atomenergi, Stockholm (Sweden).
SUMMARY DESCRIPTION OF PLANT CIRCUITS
Kristian Kull *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 1–9 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

Described are the primary circuits for the nuclear power and heating station consisting of the heavy water filled high pressure system for the reactor, the four external main coolant circuits which transport heat to the main steam generators, and the pressure control and relief system. Also discussed are the major auxiliary systems completely filled with heavy water for the annular reactor cooling circuit, the routine purification system, the control drive systems, and certain parts of the fuel element failure detection system, as well as secondary circuits that form a part of the main thermal process and are located adjacent to the primary circuits in the four main steam generators arranged around the reactor. The district heating system represents the tertiary circuit in the

main thermal process and cools the turbine condenser and the two dump condensers. The largest of the four cooling systems at the Agesta reactor comprises four recoolers in which excess heat is removed from the district heating water by a cooling-water circuit. G.G.

N67-12463# Aktiebolaget Atomenergi, Stockholm (Sweden).
AGESTA LOG
Nils Rydell and Evert Ericsson *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 10–18 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

The primary coolant system functioned satisfactorily during the first full-power operating period in spring 1964. Heavy water leakage was estimated to be a mere 25 g/h. But in the autumn of the same year a leak in the reactor lid made a long shutdown for repairs necessary. The repair was completed in the beginning of 1965, and the operation was then resumed. The operation results during the season 1965–66 were quite satisfactory. Author

N67-12464# Aktiebolaget Atomenergi, Stockholm (Sweden).
HEAVY WATER COMPONENTS
Alvar Oestman *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 19–28 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

Inspection of the secondary side of the steam generators revealed that the make-up water pipe had become loose in one type of generator and that bottom plates for make-up water distribution had fallen down in another type. Necessary improvements in the remote operation of valves have been obtained by fitting ball bearings and universal joints in manual linkages and by increasing the operating torque in motor-powered valves. Simpler and sturdier components are needed in nuclear power plants. The thermal process at the Agesta power and district heating station has worked well. All design values for flow, pressure, temperature, etc. have been achieved, and in some cases with a comfortable margin. Those difficulties which have arisen, and which to a certain extent remain to be solved, are due to shortcomings in components and the technical complexity of certain parts of the installation. Author

N67-12465# Aktiebolaget Atomenergi, Stockholm (Sweden).
SPECIAL OPERATIONAL PROCEDURES
Ingvar Holtz *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 29–37 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

The most comprehensive measures required in normal reactor operation and systems control are those connected with warm-up to 210°C (working temperature) and cool-down to ambient temperature. Up to October 1965 the reactor had been warmed up and cooled down a total of 29 times, six of these being during light water trials. Six of the warm-ups in 1965 were by the reactor's own heat. These nuclear warm-ups were part of a test program, which has yielded such favourable results that nuclear heating will be employed as routine procedure. Apart from minor troubles in maintaining pressure during the light water trials period, the warm-up and cool-down cycles have been carried through satisfactorily. The introduction of nuclear warm-up has involved minor modifications to the pipework systems. Author

N67-12466# Aktiebolaget Atomenergi, Stockholm (Sweden).
INSTRUMENTATION AND CONTROL
Ingemar Myren *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 38–47 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

The individual components of the extensive reactor monitoring and control systems have behaved well but taken as a whole there are certain defects due to inadequate liason between heat and instrumentation engineers in the design stage. The use of both valve and transistor amplifiers has shown that the latter require less maintenance. The instrumentation and control installation comprises two main parts: process instrumentation for the heat engineering systems and nuclear instrumentation together with controls for reactor power and interlocking circuits. The installation includes both valve and transistor amplifiers. Author

N67-12467# Aktiebolaget Atomenergi, Stockholm (Sweden).
FUEL AND CONTROL ROD HANDLING
Lars Brostroem *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 48–55 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

Preparatory for full power operation, the reactor was charged with 4 fuel elements intended for burnout studies and two test assemblies with no fuel material for studies of irradiated cladding materials. Control rods were used for radiation shielding and plugs were utilized to seal the standpipes against reactor pressure. After three months of full power operation, 6 fuel assemblies were removed from the reactor for measurement of their gamma activity. The straightness of the fuel assemblies for these units was found quite satisfactory. Fuelling operations for a full charge required an average of 1.1 hours for the insertion of the fuel assembly, and 1.2 hrs. to replace one fuel assembly by another during reactor physics tests. G.G.

N67-12468# Aktiebolaget Atomenergi, Stockholm (Sweden).
CHEMISTRY
Erik Lindan *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 56–65 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

With the exception of the fuel cladding the primary system is made of or lined with stainless steel. The aim of water chemistry control is, therefore, to avoid stress corrosion and other types of local attack, reducing contamination by active corrosion products and avoiding the accumulation of these products, at places as in valves and narrow flow passages, to an extent dangerous to the correct functioning of plant equipment. To assist herein all surfaces in contact with water have been given a high surface finish and a high standard of purity has been maintained in the light and heavy water used. The heavy water systems are closed circuits and water chemistry control is achieved by the use of ion exchangers in conjunction with chemical additives. Author

N67-12469# Aktiebolaget Atomenergi, Stockholm (Sweden).
RADIATION HAZARDS
Bertil Mandahl *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 66–71 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

Leakage from the primary system during operational periods was traced by measurement of radioactive hydrogen isotope tritium and was found to be extremely light with approximately 0.4 mCi/m^3 after 10 days' decay. The only personal radiation doses, recorded during full power operation, were in conjunction with inspection and work in the main steam generator room where radiation levels were relatively high. Dose rates of 100–200 mr/h, due to collected corrosion products, were recorded at pipe bends and pumps in the main circuit and near to the tube bundles and tube plates in the main steam generators. A new regulation for tritium release, taking into account the low radioactivity of this beta emitter, permits the station to release 2 Ci of beta emitter per annum of which I^{131} is the most critical. G.G.

N67-12470# Aktiebolaget Atomenergi, Stockholm (Sweden).
ELECTRICAL INSTALLATIONS
Ingvar Wetterholm *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 72–81 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

The Agesta Power Station has been provided with a comprehensive stand-by power system to ensure reactor functions

in the event of a failure of normal power supplies. However, its complexity makes this system relatively sensitive and difficult to maintain. The adoption of the quiescent current principle for reactor monitoring equipment renders in-operation service difficult. Trials are made every month to keep stand-by power equipment and the staff at fully efficiency. Some 10–12 MW of the reactor's total thermal output can be converted to electric power in the turbo-generator. The turbo-generator was transferred from an existing power station and adapted to suit the steam data at Agesta. Author

N67-12471# Aktiebolaget Atomenergi, Stockholm (Sweden).
REACTOR PHYSICS EXPERIMENTS
Goeran Apelquist and Pehr Blombert *In its* Operating Experience at the Agesta Nucl. Power Sta. Sep. 1966 p 82–107 (See N67-12461 03-22) CFSTI: HC $4.00/MF $0.75

Measured and estimated critical reactor moderator levels in the Agesta power plant, with varying numbers of fuel elements in the core, were obtained by observing material buckling as a result of neutron flux distribution deflection in the central parts of the core. Agreement between theory and experimental results was weakest when the core was largest, despite the fact that the radial reflector was then thinnest. Methods employed in determining the power distribution pattern in the core comprised analyses of recorded coolant temperature rises during passage through the fuel channels, in-core irradiation of metal foils and copper wires as used in buckling experiments, and measurements of variations in gamma activity along irradiated fuel elements. Results of dynamical experiments led to the conclusion that trapezoid disturbances are perfectly suitable for an accurate reactivity calibration. G.G.

N67-12475# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
POST-IRRADIATION STRUCTURES IN UO_2 QUENCHED OR SLOWLY COOLED FROM THE MELT
A. S. Bain Aug. 1966 62 p refs
(AECL-2587) CFSTI: HC $3.00/MF $0.75

To study the effect of cooling rate on the post-irradiation structures of UO_2, 20 mm diameter by 152 mm long fuel elements were irradiated in three separate loadings of the X-2 pressurized water loop. During the first two irradiations, one element was slowly moved from a high to a low flux position, while another was moved from a low to a high flux position. In the first loading, a third element, ESO, was also moved but it was always in a high flux position. In the third loading, the single element was stationary in a high flux position. During movement each element passed through the peak flux position. After movement, the irradiation continued for about two weeks. The fuel center temperatures (θ_0) were >2800°C in the high and ~2000°C in the low flux positions. Traces of melting which occurred during peak power periods were eliminated during subsequent irradiation with $\theta_0 = \sim 2000$°C. The fuel diametral changes were consistent and emphasized that expansions in thin-sheathed elements can be controlled by providing voidage into which the plastic UO_2 can flow. Author

N67-12476# Rheinisch-Westfalische Technische Hochschule, Aachen (West Germany). Inst. fuer Elektrische Anlagen und Energiewirtschaft.
ANALYSIS OF NUCLEAR POWER PLANTS CONSTRUCTION COSTS AND POSSIBILITIES OF REDUCING THEM, PART I AND II [ANALYSE DER ANLAGEKOSTEN VON KERNKRAFT-WERKEN UND DIE MOEGLICHKEITEN IHRER SENKUNG, TEIL I UND II]
Jun. 1966 341 p refs In GERMAN
(Contract EURATOM-020-63-12-ECID)
(EUR-2983.d, Pt. I and II) CFSTI: HC $7.00/MF $1.75

The report presented deals with the analysis of direct construction costs of nuclear power plants equipped with well tested reactors. The study comprises the cost of nuclear power plants within the 250 MW_e–1200 MW_e range. Defining the object of the study, a method of analysis is developed, which is then applied to evaluate the available cost information. Based on the analysis of construction cost of nuclear power plants being built or planned, relations are developed for the estimation of the cost of construction of nuclear power plants within a certain power range. The cost of single construction elements, dependent on the installed power of a plant is investigated by detailed analyses, and the possibilities to lower construction cost are discussed. In conclusion a statement of the results is given for six different installed power plants as well as an estimation of construction cost reduction in the foreseeable future. Author

N67-12589# India. Dept. of Atomic Energy, Bombay.
COMPUTER CODES FOR THERMAL REACTOR PHYSICS PROBLEMS
B. P. Rastogi, K. R. Srinivasan, and S. V. Lawande *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 279–282 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

To study reactor physics problems of heavy water moderated reactors with improved and reliable methods of calculations, some computer codes are described. For calculation of overall flux distribution and criticality of a core, two diffusion theory codes are mentioned. Another code reported computes the thermal neutron spectrum in cylindricalized cells of reactor lattices. Four computer codes listed deal with resonance absorption. The control rod value of a ring of control rods can be calculated by another code based on one or two group theory. A different code calculates the value of vertical control rods in a horizontal cylindrical core. The reactivity load and power output of an inpile loop can be found by using a specified two group diffusion theory program. R.U.

N67-12600# India. Dept. of Atomic Energy, Bombay.
FUEL CYCLES IN CANDU AND PHWR TYPE REACTORS
T. A. Subramanian, K. R. Srinivasan, and B. P. Rastogi *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 283–286 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Some fuel cycles for pressurized heavy water reactors are briefly described. The CANDU reactor is a 200 MW(e) pressure tube type. In this reactor, if self-produced plutonium is recycled with natural uranium the discharge irradiation is nearly doubled. Charge and discharge of fuel in the pressurized heavy water reactor (PHWR) is performed after shut-down, and its fuel cycle, considered for purposes of comparison, is equivalent to the CANDU reactor. Characteristics of equilibrium cores are summarized for initial enrichments considered, by volume ratio and discharge irradiation. To study the gradual introduction of thorium rods in the PHWR, the thorium plutonium cycle was considered. A sample result of results of thorium plutonium cycle, at volume ratio 39, and specific power 20, is tabulated for plutonium enrichment, discharge irradiation, ^{233}U production, and fissionable Pu discharged. R.U.

N67-12601# India. Dept. of Atomic Energy, Bombay.
ANALYSIS OF UNIFORM LATTICE EXPERIMENTS WITH THORIA–URANIA FUEL IN HEAVY WATER AND LIGHT WATER AS MODERATORS
H. K. Bhatia *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 287–290 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Computer codes are assessed for ThO_2–$^{235}UO_2$ or ThO_2–$^{233}UO_2$ lattices with heavy water or light water as a moderator. Both codes use the four neutron energy groups formulation. Cross sections for groups 1 to 3 were obtained by using a 54-group, Fourier-transform, slowing-down code with light water as a moderator. For thermal energy group 4, a different code was used to calculate the thermal group constants. Diffusion theory was used to calculate the various group fluxes. Results of experimental

bucklings used to obtain the value of Keff are tabulated. It is noted that the Keff deviation is more for heavy water lattices than for light water lattices. Both codes were found to predict reactivity within ±1% for natural or slightly enriched UO_2 lattices of interest to power reactor technologists. From the thorium experiments, it is seen that both codes overestimate the reactivity by about 2%. R.Ll.

N67-12602# India. Dept. of Atomic Energy, Bombay.
NEUTRON THERMALISATION IN LATTICES: PROGRAM THERMNIL
V. K. Jain and S. V. Lawande *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 291–295 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A method is reviewed for computing thermal neutron-flux distribution as functions of energy and a single spatial coordinate. The axial direction is taken as infinite, and the method used is the multigroup, multizone formulation of the Boltzmann equation. Equations are derived for the isotropic neutron scattering, and for the numerical calculation of fluxes. Expressions are given to calculate the collision probability, and the source term. For transfer and scattering cross sections the kernel technique is used. After calculating the fluxes to a required accuracy, a number of relating parameters are also computed. The program calculates the disadvantage factor, average cross-sections, neutron temperatures at each space zone, as well as in each mixture, and average cross sections of the materials put in the form of foils. R.Ll.

N67-12603# India. Dept. of Atomic Energy, Bombay.
THERMAL NEUTRON SPECTRA IN REACTOR LATTICES: PROGRAM LATSP
S. V. Lawande *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 296–299 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Effects of neutron leakage into and absorption by fuel elements present in a heterogeneous reactor are considered. The Boltzmann equation is replaced by exact and more complicated forms of the transport equation involving space, energy, and angle as variables. A Fortran program LATSP is described, and results for enriched U light water lattices and U-D_2O lattices are tabulated and compared with those of another set of computer calculations. S.P.

N67-12604# India. Dept. of Atomic Energy, Bombay.
MULTIPLE COLLISION PROBABILITIES IN THIN SLABS
D. C. Sahni *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 300–302 ref (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

An isotropically scattering plane slab is considered with respect to multiple collision probabilities used to obtain the neutron flux distribution in a cell. Studies were made of the dependence of these collision probabilities on the angular distribution of incoming neutrons in plane geometry. Since the annular regions are normally very thin and surround a rod of large radius, the results can be applied to thin annuli. S.P.

N67-12606# India. Dept. of Atomic Energy, Bombay.
TEMPERATURE DEPENDENT EFFECTIVE MULTIGROUP CAPTURE CROSS SECTON OF THORIUM
R. Shankar Singh *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 307–311 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Results presented contain the capture cross section of ^{232}Th at four temperatures in the lower eleven groups of a 22-group cross section set. The s- and p-wave contributions to the capture cross sections in the unresolved resonance region are tabulated separately. There are only three groups in this region as compared with four groups in earlier studies, since resonances are resolved up to 4000 eV. For the p-wave parameters two values of the strength function (0.69×10^{-4} and 2.2×10^{-4}) were chosen and computed capture cross sections were compared with the experimental results. The value of 2.2×10^{-4}, which gave a better fitting was finally chosen for the p-wave strength function. A comparison of the present results with previous ones shows some small changes in the capture cross sections, and their effect on the Doppler reactivity coefficients can be judged only after survey calculations for specific reactor systems. S.P.

N67-12615# India. Dept. of Atomic Energy, Bombay.
A TWO PARAMETER ANALYSING FACILITY FOR COINCIDENCE EXPERIMENTS IN NUCLEAR REACTIONS
N. L. Ragoovansi, P. C. Mitra, and M. A. Eswaran *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 348–350 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A system was built which extends the utility of the TMC 400 channel pulse height analyzer to that of a two-parameter analyzer by making use of a 20-channel Gatti-type pulse height analyzer; this is accomplished by incorporating fast–slow coincidence systems. The facility is designed for use in coincidence experiments in nuclear reactions involving simultaneous pulse height analysis of spectra from two different radiation detectors. Essential features of the facility are shown in a block diagram. The facility has been used in proton-gamma ray angular correlation measurements in the reaction $^{26}Mg(d,p\gamma)^{27}Mg$. K.W.

N67-12688# Aktiebolaget Atomenergi, Stockholm (Sweden).
ONE-GROUP PERTURBATION THEORY APPLIED TO MEASUREMENTS WITH VOID
R. Persson Sep. 1966 22 p refs Revised Ed. of AE-72
(AE-248; AE-72) CFSTI: HC $1.00/MF $0.50

Formulas suitable for evaluating progressive as well as single-rod substitution measurements are derived by means of one-group perturbation theory. The diffusion coefficient may depend on direction and position. By using the buckling concept one can derive expressions which are quite simple and the perturbed flux can be taken into account in a comparatively simple way. By using an unconventional definition of cells a transition region can be introduced quite logically. Experiments with voids around metal rods, diameter 3.05 cm, have been analysed. The agreement between extrapolated and directly measured buckling values is excellent, the buckling difference between lattices with water-filled and voided shrouds being $0.263\pm0.015\ m^{-2}$ and $0.267\pm0.005\ m^{-2}$ respectively. From single-rod experiments differences between diffusion coefficients are determined to $\delta D_t/D = 0.083\pm0.004$ and $\delta D_z/D = 0.020\pm0.016$. With air-filled shrouds there is consequently anisotropy in the neutron diffusion and we have $(D_z/D_t)_{air} = 1.034\pm0.020$. Author

N67-12690# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Operations Div.
ANALYTICAL PROCEDURES (1966) FOR THE HEAVY WATER AND HELIUM SYSTEMS OF THE NRX AND NRU REACTORS
D. C. Austen, D. J. Campbell, and A. R. Colp Jun. 1966 136 p refs
(AECL-2596) CFSTI: HC $4.00/MF $1.00

CONTENTS:

1. THE ISOTOPIC ANALYSES OF HEAVY WATER BY INFRARED SPECTROPHOTOMETRY D. C. Austen 44 p refs (See N67-12691 03-22)

2. THE IDENTIFICATION AND MEASUREMENT OF IONIC IMPURITIES IN HEAVY WATER D. J. Campbell 56 p ref (See N67-12692 03-22)

3. GAS ANALYSIS A. R. Colp 18 p (See N67-12693 03-22)

N67-12691# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE ISOTOPIC ANALYSES OF HEAVY WATER BY INFRARED SPECTROPHOTOMETRY
D. C. Austen *In its* Anal. Procedures (1966) for the Heavy Water and Helium Systems of the NRX and NRU Reactors Jun. 1966 44 p refs (See N67-12690 03-22) CFSTI: HC $4.00/MF $1.00

Details are given on the use of a recording spectrophotometer equipped with a sodium chloride prism for accurately analyzing the isotopic value of an unknown sample of D_2O. It is pointed out that the infrared method is applicable, with slight modifications, to D_2O concentrations from natural (0.017% D_2O) to 99.95 wt.% D_2O. Also described is a precision refractometer with a range of 1.30 to 1.51 which is used to determine the isotopic composition of heavy water–light water mixtures. Although it is not accurate enough for accounting purposes, it is considered useful for qualitative work due to its speed and simplicity. For the isotopic analysis of heavy water in all concentrations, a differential refractometer is used. The instrument has a change of 1×10^{-5} refractive index units for full scale deflection of the recorder. The principle, theory, and analytical procedures for each method are given. Data are included on the conversion of mol. % D_2O to weight % D_2O, and precautions for storing, handling, and sampling heavy water are discussed. M.G.J.

N67-12692# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE IDENTIFICATION AND MEASUREMENT OF IONIC IMPURITIES IN HEAVY WATER
D. J. Campbell *In its* Anal. Procedures (1966) for the Heavy Water and Helium Systems of the NRX and NRU Reactors Jun. 1966 56 p ref (See N67-12690 03-22) CFSTI: HC $4.00/MF $1.00

Sampling of the reactor moderator systems by using a sampling bomb and by inserting a hypodermic syringe into a sample point is discussed, along with the necessary safety precautions which must be observed. The procedures used to clarify heavy water prior to chemical analysis are listed, and typical analytical results are tabulated. Fifteen analytical procedures are described: the determination of flow pH, and of flow conductivity; the colorimetric determinations of nitrate by the 2,6-xylenol method, of nitrate by the sulfanilic acid method, of chloride by the mercuric thiocyanate method, of ammonia by the Nessler method, of peroxide by the titanium sulfate method, of aluminum by the Ferron method, of iron by the ortho-phenanthroline method, of chromium by the diphenyl carbazine method, of mercury by the dithizone method, and of copper by the neocuproine method; the flame photometric determination of sodium; the fluorimetric determination of uranium by the sodium fluoride fusion method; and the measurement of organic material by the permanganate demand method. M.G.J.

N67-12693# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
GAS ANALYSIS
A. R. Colp *In its* Anal. Procedures (1966) for the Heavy Water and Helium Systems of the NRX and NRU Reactors Jun. 1966 18 p (See N67-12690 03-22) CFSTI: HC $4.00/MF $1.00

The sampling techniques for the helium system, and the heavy water sampling method for dissolved gases are described, and the limitations of the gas chromatograph and the mass spectrometer used for the gas analyses are discussed. The gas chromatograph, a vapor fractometer with a 2 meter 5A molecular sieve packed column, depends on the differences in affinity of the column packing material for the various components of the sample. The mass spectrometer relies on mass difference to effect separation, and is useful in identifying and measuring small quantities of unknowns. It is pointed out that error with either instrument can be minimized by the proper use of standards. Details are given on the preparation of these standards which are used to calibrate both instruments, and to prepare curves that may be used for most samples. For those samples with high concentration of impurities, special standards closely approximating the sample in composition are normally prepared. Standards giving readings on both sides of the sample, from which the sample composition may be calculated are found to yield the most accurate results. M.G.J.

N67-12696# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE EFFECT OF PREFERRED ORIENTATION ON THE MECHANICAL PROPERTIES AND DEFORMATION BEHAVIOUR OF ZIRCALOY-2 FUEL SHEATHING
K. P. Steward and B. A. Cheadle Aug. 1966 52 p refs
(AECL-2627) CFSTI: HC $3.00/MF $0.50

Axial tensile, ring tensile, closed end burst, and free end burst tests were carried out at room temperature and 300°C on six batches of Zircaloy-2 sheathing covering a wide range of textures and percentages of residual cold work. Knoop hardness tests were also done on all batches. The mechanical properties of the tubes are largely dependent on the percentages of cold work, but are also markedly affected by the textures, particularly with respect to deformation behaviour. The deformation behaviour observed confirms Picklesimer's predictions, whilst Knoop hardness results can be correlated with texture and yield strength anisotropy after the method of Wheeler and Ireland. From the mechanical properties, and from effective strain values determined at the fractures using a photogrid technique, it is concluded that tubing with a single preferred orientation of radial basal poles shows the best combination of strength and ductility for any given degree of cold work. Author

N67-12825# Aktiebolaget Atomenergi, Stockholm (Sweden).
THE INTERACTION BETWEEN CONTROL RODS AS ESTIMATED BY SECOND-ORDER ONE-GROUP PERTURBATION THEORY
R. Persson Oct. 1966 43 p refs
(AE-250) CFSTI: HC $2.00/MF $0.50

The interaction effect between control rods is an important problem for the reactivity control of a reactor. The approach of second-order one-group perturbation theory is shown to be attractive due to its simplicity. Formulas are derived for the fully inserted control rods in a bare reactor. For a single rod we introduce a correction parameter b, which with good approximation is proportional to the strength of the absorber. For two and more rods we introduce an interaction function $g(r_{ij})$, which is assumed to depend only on the distance r_{ij} between the rods. The theoretical expressions are correlated with the results of several experiments in RO, ZEBRA and the Agesta reactor, as well as with more sophisticated calculations. The approximate formulas are found to give quite good agreement with exact values, but in the case of about eight or more rods higher-order effects are likely to be important. Author

N67-12867# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TIME OPTIMAL XENON SHUTDOWN ON THE XENON BOUNDARY
Jeffery Lewins and R. D. Benham May 1966 38 p refs
(Contract AT(45-1)-1830)
(BNWL-136) CFSTI: HC $2.00/MF $0.50

The time optimal flux program to shutdown a reactor without losing restart capability through Xe poisoning is reviewed. A more rigorous proof of the optimal nature of operating along the Xe boundary is offered, together with a discussion of situations which might not be optimal. It is concluded that for practical purposes operation along the boundary will be optimal. Part of the proof consists of analog computations, and a discussion is given of the suitability of the optimum Xe study to analog techniques. Author (NSA)

N67-12868# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

ISOSHLD--A COMPUTER CODE FOR GENERAL PURPOSE ISOTOPE SHIELDING ANALYSIS

R. L. Engel, (Computer Sci. Corp.), M. M. Hendrickson (Hanford Atomic Products Operation), and J. Greenborg Jun. 1966 147 p refs

(Contract AT(45-1)-1830)

(BNWL-236) CFSTI: HC $4.00/MF $1.00

ISOSHLD is a computer code to perform gamma ray shielding calculations for isotope sources in a wide variety of source and shield configurations. Attenuation calculations are preformed by point kernel integration; for most geometries by Simpson's rule numerical integration. Source strength in uniform or exponential distribution (where applicable) may be calculated by the linked fission product inventory code RIBD or by other options as desired. Buildup factors are calculated by the code based on the number of mean free paths of material between the source and detector points, the effective atomic number of a particular shield region (the last unless otherwise chosen), and the point isotropic NDA buildup data available as Taylor coefficients in the effective atomic number range of 4 to 82. Other data needed to solve most isotope shielding problems of practical interest are linked to ISOSHLD in various libraries. Author (NSA)

N67-12873# Oak Ridge National Lab., Tenn.

UNIT OPERATIONS SECTION Quarterly Progress Report, Oct.–Dec. 1965

M. E. Whatley, P. A. Haas, R. W. Horton, A. D. Ryon, J. C. Suddath et al Jul. 1966 60 p refs

(Contract W-7405-ENG-26)

(ORNL-3958) CFSTI: HC $3.00/MF $0.75

Studies are reported on stacked-clone solvent extraction contactor; shear-leach processing of power reactor fuels; grind-leach processing of graphite fuels; engineering separation of macromolecular biological substances; urania-sol preparation; thorium microsphere preparation; pulse-column tests; berkelium extraction-rack tests; and waste processing. NSA

N67-12875# Oak Ridge National Lab., Tenn.

DEVELOPMENT OF A FORMING METHOD FOR CURVED ATR FUEL PLATES

J. H. Erwin, Sigfred Paterson, and C. F. Leitten, Jr. Aug. 1966 38 p refs

(Contract W-7405-ENG-26)

(ORNL-3983) CFSTI: HC $2.00/MF $0.50

The design and operating conditions of the Advanced Test Reactor fuel elements dictate rigid control and reproducibility of the fuel-plate forming practice. Unlike those in conventional test reactor fuel elements, the width and radius of curvature of each of the 19 fuel plates that make up an individual ATR assembly are all different. These radius and curvature requirements were successfully met by using a process consisting of underforming the plate, measuring the degree of springback the plate had encountered, and finally on the basis of this observed springback selecting the desired die for reforming the plate to the required radius. When the plates had been cold reduced 7.4%, the springback and forming producibility depended on subtle variations in fabrication history. Better reproducibility of forming followed a process that included 20% cold reduction. Use of more than two forming steps did not improve accuracy and reproducibility of forming. NSA

N67-12876# Atomics International, Canoga Park, Calif.

THE APPLICATION OF K-FACTORS FOR RELIABILITY EVALUATION OF TEST PROGRAMS

R. H. Anderson 15 Jul. 1966 16 p refs

(Contract AT(11-1)-GEN-8)

(NAA-SR-11913) CFSTI: HC $1.00/MF $0.50

The basic concepts of K-factors are presented along with information on their application, and the constraints that must be considered in their use for reliability prediction. Their application in the reliability prediction for SNAP fuel elements is discussed in detail as well as case histories of their effective use in other work. The extensive trend towards the use of K-factors for the reliability prediction of space systems is reviewed. NSA

N67-12877# Atomics International, Canoga Park, Calif.

AN ANALOG COMPUTER STUDY OF THE DYNAMICS OF THE MRP COMBINED ROTATING UNIT SHAFT-BEARING SYSTEM

J. H. Bick and A. G. Presson 15 Jul. 1966 76 p refs

(Contract AT(11-1)-GEN-8)

(NAA-SR-11943) CFSTI: HC $3.00/MF $0.75

A mathematical model formulated for the combined rotating unit shaft-bearing system is discussed. The model includes the effects of shaft imbalance, magnetic rotational load, unidirectional load, and spin speed on the shaft dynamics. The bearing forces include hydrodynamic, hydrostatic, and squeeze film forces. It is possible to vary independently all bearing parameters as well as supply pressure. A short parameter survey of the combined rotating unit operating conditions and of the stability envelope was completed, based on the mathematical model. The results are most encouraging as regards their correlation with experimental data. The theory and assumptions used in the derivations are given. Recommendations are made for improvements and suggested future investigation. Author (NSA)

N67-12878# Atomics International, Canoga Park, Calif.

SNAP 10A EXPANSION COMPENSATOR Final Report

L. R. Stone and W. D. Whitaker 15 Jul. 1966 81 p refs

(Contract AT(11-1)-GEN-8)

(NAA-SR-11962) CFSTI: HC $3.00/MF $0.75

The SNAP 10A Space Nuclear Power Unit was successfully flight tested utilizing expansion compensator units (ECUs) to absorb the NaK coolant thermal expansion and to pressurize the coolant system with a void-free device. An expansion compensator design utilizing a welded bellows assembly was extensively tested to ensure conformance with the SNAP 10A operational and reliability requirements. A unique feature of the ECU design was a secondary containment housing which would have permitted continued system operation at design conditions in the event of a bellows failure. The bellows assembly was fabricated from AM-350 (SCT-850) precipitation hardened steel foil. Component development and qualification tests were successfully performed. Expansion compensators were also installed on two SNAP 10A ground test systems which met all test objectives. A total of 71,200 hr at elevated temperatures was accumulated during the development and qualificatio testing of the ECUs. Author (NSA)

N67-12883# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

INITIAL RESULTS OF THE IN-REACTOR COMPATIBILITY OF UO_2 WITH REFRACTORY METALS, OXIDES AND GRAPHITE

R. D. Mac Donald Jul. 1966 21 p refs

(AECL-2601) CFSTI: HC $1.00/MF $0.50

Four Zircaloy-2 clad fuel elements were irradiated for one reactor cycle to investigate the high temperature (up to 2300°C) compatibility of UO_2 with discs of W, Re, Mo, Ta, Nb, Al_2O_3 and ThO_2 and with graphite rings. Two elements were destructively examined. The metal discs had altered the temperature profile of the UO_2 pellets, reducing the metal–UO_2 interface temperatures to about 1550°C compared with 2280°C at the middle of the pellet. No reaction between the discs and fuel was observed; however, most of the disc materials had recrystallized and most metal discs exhibited plastic flow. The two intact elements will be re-irradiated at higher heat ratings to increase the probability of a reaction between the UO_2 and disc materials. Author

N67-12892# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
ON A STOCHASTIC PROBLEM IN NON-LINEAR SYSTEMS WITH A REFERENCE TO CORRELATIONS IN NUCLEAR REACTOR THEORY
J. Larisse Brussels, EURATOM, Sep. 1966 22 p refs
(EUR-3074.e) CFSTI: HC $1.00/MF $0.50

This report describes a stochastic non-linear system, a particular case of which is a nuclear reactor. We derive a functional equation between the statistical properties of the input, the output and the characteristic function of the unit impulse response, from which it is possible to obtain a general method of calculation of correlations. Author

N67-13036# Naval Civil Engineering Lab., Port Hueneme, Calif.
UNDERSEA NUCLEAR POWER Status Report (Final), Jul. 1964–Dec. 1965
E. J. Beck Aug. 1966 15 p refs
(R-470; AD-636920) CFSTI: HC $2.00/MF $0.50

Since the publication in 1964 of Techniques for Underwater Nuclear Power considerable research and development has been done which has changed the picture regarding the feasibility of using isolated reactors on the ocean bottom. This study considers in some detail the work on fouling, corrosion, and heat transfer accomplished. Also considered are additional problems which might be encountered in using radioisotope decay heat in large (multi-kilowatt) generators or fuel cells in the deep ocean environment. A cursory up-dating of the known arts related in the earlier study is made, especially in referencing material which has recently become available. Possible areas for further investigation are delineated. Author (TAB)

N67-13093# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
REACTOR CELL PARAMETERS IN MULTIGROUP COLLISION PROBABILITY THEORY
L. Amyot Sep. 1966 34 p refs
(EUR-3075.e) CFSTI: HC $2.00/MF $0.50

A consistent set of definitions of the reactor cell parameters is presented and discussed in the framework of the multigroup, multiregion collision probability technique. The assumptions implied in the fundamental neutron balance and, in particular, the link with more general integral transport theory, are examined in the light of the recent literature on the subject. Author

N67-13248# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
RSAC—RADIOLOGICAL SAFETY ANALYSIS COMPUTER PROGRAM
R. L. Coates and N. R. Horton May 1966 212 p refs
(Contract AT(10-1)-205)
(IDO-17151) CFSTI: HC $6.00/MF $1.25

An IBM 7040 computer program is presented which is used to compute the potential radiological doses resulting from either a continuous or instantaneous release of radioactive fission products to the atmosphere. This program, the Radiological Safety Analysis (RSAC) Program, is written in Symbolic Language (MAP). The program has been developed as part of the LOFT and the general nuclear safety programs to provide a generalized computer program for a complete parametric investigation of the radiological hazards from any nuclear power plant or reactor system. The doses considered are cloud gamma, deposition gamma, ingestion, and inhalation, and are based upon the release of up to 200 isotopes, the relative abundance of each isotope being dependent upon the operating history of the nuclear reactor under consideration. Included are the mathematical models, conversion factors, assumptions, flow charts, program listings, and other data considered pertinent to the overall development of this program. NSA

N67-13255# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
NONDESTRUCTIVE TEST OF CARBON BEDS FOR REACTOR CONFINEMENT APPLICATIONS Progress Report, Oct. 1964–Jan. 1966
David R. Muhlbaier Jun. 1966 30 p refs
(Contract AT(07-2)-1)
(DP-1063) CFSTI: HC $2.00/MF $0.50

A nondestructive in-place test for detecting leaks in a bank of installed carbon beds with Freon-112 tracer was developed by the Savannah River Laboratory and demonstrated in the reactor confinement facilities at the Savannah River Plant. Leakage flow (flow that bypasses the carbon) of 0.01% of the total air flow through the beds is detected readily. Installed carbon beds with about 2 years exposure to exhaust air flow in the confinement system were evaluated successfully with the test. Standardization of the test is in progress for general application to in-place testing of carbon beds. Author (NSA)

N67-13268# Battelle Inst., Frankfurt am Main (West Germany).
HIGH-TEMPERATURE TESTS ON TUNGSTEN-COATED UO_2-MO-CERMETS FOR THERMIONIC NUCLEAR FUEL ELEMENTS [HOCHTEMPERATTURTESTS AN MIT WOLFRAM UMHUELLTEN UO_2-MO-CERMETS FUER THERMIONISCHE REAKTOR-BRENNELEMENTE]
K. Schuster Apr. 1966 34 p refs In GERMAN; ENGLISH summary
(MWF-FBK-66-08)

Cermets composed of UO_2 and Mo and coated with W were evaluated for their properties at high temperatures. Heating for long periods at temperatures up to 1800°C caused some of the cermets to swell. Mo and W diffused in a short time after the start of the test. The structure of the W coating changed, and quantities of UO_2 gradually escaped. (NSA)

N67-13280# General Electric Co., San José, Calif. Nuclear Technology Dept.
SPECIFIC ZIRCONIUM ALLOY DESIGN PROGRAM Quarterly Progress Report
H. H. Klepfer and R. E. Blood Apr. 1966 15 p refs
(Contract AT(04-3)-189)
(GEAP-5134; EURAEC-1654; QPR-12) CFSTI: HC $1.00/MF $0.50

A Zr+2.0 at.% Cr+0.16 at.% Fe alloy is being evaluated as nuclear fuel cladding. Alloy-clad fuel rods are to be irradiated to a target exposure of 15,000 Mwd/t. A process is proposed for producing high-performance uniform intermetallics under vendor conditions. A slab of the ingot to be used for a second batch of tubing was fabricated by three alternate schedules including that proposed to ensure fine uniform intermetallics. Cooling rates, reductions in area, and process times were controlled to simulate vendor conditions. Metallographic, tensile, and corrosion test data on the resultant material prompted minor refinements in the reference process for tubing fabrication. The new reference process is being confirmed in the laboratory on quenched vendor forging material. Vendor fabrication of tubing was authorized. The laboratory confirmation tests are leading the tubing process; each tubing step is being reviewed before fabrication. NSA

N67-13289# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
A NOTE ON THE FAST FRACTURE OF A PRESSURE VESSEL
G. Hake May 1966 10 p refs
(AECL-2432)

An indication of the size of opening that results when a pressure vessel or pressure piping, which contains a through-defect shorter than the critical length, is initially brought to operating conditions is given. This information is relevant to the analysis of the loss of the coolant accident. Author (NSA)

N67-13302# Commissariat a l'Energie Atomique, Saclay (France). Service d'Electronique Physique.
RADIOISOTOPE CONVERTERS [CONVERTISSEURS A RADIOISOTOPES]
Thierry Alleau, Bernard Devin, and Michel Vandevy Ver Jun. 1966 14 p refs In FRENCH
(CEA-R-2788)

Due to the surface power density required for thermoelectric and thermoionic converters, available radioactive sources are surveyed and listed. Curves of specific minimum diameter versus thermal flux density are given. ^{210}Po and ^{242}Cm appear to be suitable for direct thermionic while alpha emitters such as ^{238}Pu and ^{244}Cm are still suitable for thermoelectric conversion. This mode will also work with beta emitters ^{170}Tm, ^{90}Sr, ^{144}Ce, and ^{137}Cs. Some thermoelectric radioisotope heated converters are suggested. Author (NSA)

N67-13322# Gmelin-Institut fuer Anoganische Chemie und Grenzgebiete, Frankfurt am Main (West Germany). Zentralstelle fuer Atomkernenergie-Dokumentation.
BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND SECTION 22: NUCLEAR SHIP PROPULSION
J. N. Paro comp. (Reactor Centrum, The Hague) Jun. 1966 48 p refs
(AED-C-22-06)

A compilation of 113 references is presented on the application of nuclear reactors and radioisotopes to surface and underwater ship propulsion. Author, report number, and subject indexes are included. NSA

N67-13324# Battelle-Northwest, Richland, Wash.
FORMATION OF SELECTED FISSION PRODUCTS IN POWER REACTORS
C. A. Rohrmann and E. T. Merrill May 1966 48 p refs Revised
(Contract AT(45-1)-1380)
(BNWL-244) CFSTI: HC $2.00/MF $0.50

Fission product production data are tabulated as a function of fuel exposure for specific reactor conditions. Calculated cross sections and potential large scale uses are listed for typical fission product isotopes. The production data were calculated using the ALTHAEA-MELEAGER computer code. The two groups of reactor parameters were based on a slightly enriched U PWR and on a similar PWR fueled with natural U enriched with Pu. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N67-12425# Joint Publications Research Service, Washington, D. C.
AUTOMATING THE CONTROL OF MACHINES WITH THE AID OF AN OPTICAL RAY
S. T. Tsukkerman *In its* Izv. VUZov: Instr. Bldg. 12 Oct. 1966 p 112–117 refs (See N67-12401 03-14) CFSTI: $4.00

The author reviews the problems of automatic control of earth-moving machines with the aid of an optical ray; he describes the operating principle and a diagram of the "RCD" devices (ray-controlled devices). He presents data on the results obtained from testing the RCD devices. Author

N67-12434# Wisconsin Univ., Madison. Mathematics Research Center.
ANALYSIS OF QUADRIPOLE METHODS FOR THE VELOCITY OF SOUND Technical Summary Report
R. A. Gaggioli, I. C. Romer, Jr., and A. S. El-Hakeem Jan. 1966 60 p refs
(Contract DA-11-022-ORD-2059)
(MRC-634; AD-638659) CFSTI: HC $3.00/MF $0.75

A general analysis is presented of the systematic errors in phase detection and amplitude detection methods for establishing the velocity of sound propagated through gases in tubes. Author (TAB)

N67-12440# Wisconsin Univ., Madison. Mathematics Research Center.
THE NEAR-FIELD BEHAVIOR OF THE GREEN'S MATRIX IN ANISOTROPIC WAVE MOTION Technical Summary Report
Geraldo S. S. Avila and Calvin H. Wilcox May 1966 33 p refs
(Contract DA-11-022-ORD-2059)
(MRC-661; AD-638651) CFSTI: HC $2.00/MF $0.50

The paper discusses the Green's matrix G (x) for steady-state wave propagation in homogeneous anisotropic media. Explicit approximations are derived for G (x) when x is near the source point x = 0. Author (TAB)

N67-12534# Harvard Univ., Cambridge, Mass. Div of Engineering and Applied Physics.
A DENSE PACKING OF HARD SPHERES WITH FIVE-FOLD SYMMETRY
B. G. Bagley Jan. 1966 5 p refs Repr. from Nature (London), v. 208, no. 5011 13 Nov. 1965 p 674–675 refs
(Contract Nonr-1866(50))
(TR-5; AD-630573)

A packing sequence for hard spheres is described in which a plane is constructed such that the spheres form concentric pentagons with an odd number of balls per pentagon side. The sequence permits construction of an infinite structure, the nucleus of which is a pentagonal dipyramid of seven spheres. Application of this packing sequence to other polygons is briefly discussed, and structures having the same type of symmetry are mentioned. Experimental observations of fivefold symmetry in cobalt crystals, synthetic diamonds, copper dendrites, and sub-micron whiskers of nickel, iron, and platinum are also discussed. K.W.

N67-12623# European Organization for Nuclear Research, Geneva (Switzerland). Div. of the Proton Synchrotron Machine.
PRIMARY BEAM OPTICS [OPTIQUE DES FAISCEAUX PRIMAIRES]
C. Bovet 2 Aug. 1966 34 p refs In FRENCH; ENGLISH summary
(CERN-66-25)

When an external target (or even several external targets in series) are used, then *primary beam optics* are relevant to the transfer of the beam from the extraction point to the targets. A primary beam is characterised by a non-uniform density in the transverse phase space (y, dy/dz, z, dz/dz). In this paper an analytical formula to this density is given, and also definitions of emittance and beam envelope, which may be calculated at every point of the transfer system. The analysis allows us to consider linear elements as well as the effects of diffusing media (energy loss and multiple scattering) and also the dispersion effects of the bendings, due to $\Delta p/p$. (One obtains, therefore, the increase of the emittance when a beam traverses a volume of material or undergoes deflections). A Fortran program is available. Author

N67-12652# Naval Research Lab., Washington, D. C.
FLASHLAMP SPECTROSCOPY
F. D. Harrington *In its* NRL Progr. in High-Power Laser Res. 10 Jun. 1966 p 30–38 ref (See N67-12645 03-16) CFSTI: HC $2.00/MF$0.50

Described is an external optical system for time-resolved spectroscopic studies of pulsed flash lamps that might be used as laser pumps. The spectrograph was made time-resolving by a gas-driven rotating plane mirror, positioned ahead of the 20-mm entrance slit, to sweep the image along the slit. A beam splitter in the external optical system allows a monochromator to observe photoelectric intensity and time duration of a single pulse from the flashlamp as well as the spectral radiance versus wavelength. The current as a function of time is displayed on an oscilloscope along with the monochromator pulse. A complete study of the a 103-0 spectroscopic film and instrumentation calibration from 3300 to 5000 Å was made, and a method for data reduction from time-resolved spectrographs was developed. G.G.

N67-12655# Oslo Univ., Blindern (Norway). Inst. of Theoretical Astrophysics.
THE INFLUENCE OF A SCANNING SLIT ON THE LINE PROFILE OBSERVED WITH A SPECTROGRAPH
Rolf Brahde Repr. from Astrophys. Norvegica (Norway), v. 9, no. 21, 1965 p 199–212 refs
(Contract AF 61(052)-743)
(SR-3; AFCRL-66-216; AD-632168) CFSTI: HC$1.60/MF$0.50

In a spectrograph the diffraction profile of either a rectangular or a circular opening is folded with the image of two rectangular finite slits–the spectrograph slit and a scanning slit. The resulting intensity distribution has been studied for the two cases incoherent and coherent illumination of the slit. Author (TAB)

N67-12662# California Inst. of Tech., Pasadena.
RADIATION OF A POINT CHARGE MOVING UNIFORMLY OVER AN INFINITE ARRAY OF CONDUCTING HALF-PLANES
John Lam Aug. 1966 129 p refs
(Contract AF 49(638)-1266)
(TR-37; AD-640819) CFSTI: HC$4.00/MF$1.00

The problem of the excitation of an infinite array of parallel, semi-infinite metallic plates by a uniformly moving point charge is studied by the Wiener–Hopf method. It is treated as a boundary value problem for the potentials of the diffracted electromagnetic fields. The formulation of this problem makes use of the well-known conditions on the electromagnetic fields at a metallic boundary. A method is used to translate these boundary conditions on the fields into boundary conditions on the potentials. In this way the problem is formulated in terms of a set of dual integral equations for the current densities induced on the plates by the point charge. These integral equations are exactly soluble by the Wiener–Hopf technique. The solutions are found to satisfy the famous edge conditions for diffraction problems, and are therefore unique. From these solutions exact expressions for the diffracted fields are derived in the form of Fourier integrals. It is seen that these fields represent a radiation of electromagnetic energy. The method of steepest descent is then to obtain expressions for the radiation fields, the poynting vector, the frequency spectrum and the radiation pattern. The radiation shows that the array of plates behaves both like a diffraction grating and a series of parallel-plate waveguides. Author (TAB)

N67-12784# Joint Publications Research Service, Washington, D. C.
EFFECT OF DEVIATION IN PARAMETERS OF VARIABLE-ENLARGEMENT OPTICAL SYSTEMS ON THE DISPLACEMENT OF THE IMAGE PLANE
I. I. Pakhomov and V. A. Perov N67-12761 03-14) CFSTI: $5.00

The effect of deviations in parameters of variable-enlargment optical systems on the displacement of the image plane is investigated. Conditions are given for an efficient selection of the magnitude and sign of the deviations in order to reduce the displacement of the image plane and obtain a mutual compensation of errors. Author

N67-12785# Joint Publications Research Service, Washington, D. C.
MODULATION OF RADIANT FLUX BY MEANS OF TWO GRATINGS
V. V. Dronov and Yu. V. Lyubimov *In its* Izv. VOZov: Instr. Bldg., Vol. IX, no. 4 22 Nov. 1966 p 108–113 ref (See N67-12761 03-14) CFSTI: $5.00

An analytical investigation was conducted of the character of a radiant flux modulated with the aid of two gratings or rasters. Compared with flux modulation by using one grating or raster, the modulation by means of two gratings offers large prospects for processing and transmission of coded information. Author

N67-12788# Joint Publications Research Service, Washington, D. C.
INTERFERENCE METHOD OF CHECKING THE THICKNESS OF TRANSPARENT LAYERS ON SURFACES WITH RELATIVELY LARGE CURVATURE
B. A. Shapochkin *In its* Izv. VUZov: Instr. Bldg., Vol. IX, no. 4 22 Nov. 1966 p 125–130 refs (See N67-12761 03-14) CFSTI: $5.00

A method is described for checking the thickness of transparent layers on surfaces with relatively large curvatures by using interference rings formed by illumination from the focus of a surface. Figures illustrate the method, the experimental unit, and the interference bands. It was concluded that although the method extends the classic Newton-rings method, it retains simplicity and is accurate. L.E.W.

N67-12858# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
EXPERIMENTS OF APPRECIABLE NUCLEAR MAGNETIC RESONANCE ON WEAK CONTINUOUS MAGNETIC FIELDS [EXPERIENCE DE RESONANCE MAGNETIQUE NUCLEAIRE SENSIBLE AUX CHAMPS MAGNETIQUES CONTINUS FAIBLES]
Guy Hanuise 1966 9 p refs In FRENCH Presented at the 14th Colloq. Ampere on Resonance and Magnetic Relation, Ljubljana, Yugoslavia, 6–11 Sep. 1966
(TP-398(1966)) CFSTI: HC$1.00/MF$0.50

Methods used in classical experiments on nuclear magnetic resonance are extended to the solution of normal Bloch equations for a system formed by two parallel magnetic fields (one a large amplitude alternate field, and the other a continuous field) and a continuous excitation field. Theoretical and experimental results on the amplitudes and lengths of resonance lines are presented. Replacing the field of excitation by a rotation enables calculations to be made of the value and the character of the gyromagnetic ratio. Schematics complete the analytical data. Transl. by R.Li.

N67-12874# Oak Ridge National Lab., Tenn.
METHODS OF REDUCTION OF TEXTURE DATA TO INVERSE POLE FIGURES
R. O. Williams Aug. 1966 26 p refs
(Contract W-7405-ENG-26)
(ORNL-3979) CFSTI: HC $2.00/MF $0.50

Several methods have been devised to facilitate the inversion of texture data to inverse pole figures, which give the distribution of a physical direction over the crystallographic triangle. Graphical integration is replaced by summing the distribution over a set of points. The coordinates of these sets are given for seven planes in

the cubic system. A graphical method is presented which gives an improved starting distribution and will give an adequate inversion for simple textures. Author (NSA)

N67-12936*# National Bureau of Standards, Washington, D. C.
ON THE CORRELATION OF SPECTRAL IRRADIANCES AS DETERMINED THROUGH THE USE OF PRISM AND FILTER SPECTRORADIOMETRIC TECHNIQUES
William E. Schneider, Ralph Stair, and John K. Jackson Oct. 1966 36 p refs
(NASA Order R-116)
(NASA-CR-80191; NBS-9451) CFSTI: HC $2.00/MF $0.50 CSCL 20F

Two sets of instrumentation were set up and independently used to determine spectral irradiances of various sources over the solar spectrum. One set is based on a conventional monochromator, and the other is a system employing narrow bandpass interference filters to isolate the radiant energy into discrete wavelengths. The close correlation of the spectral irradiances of the sources examined through the use of both the prism spectroradiometer and the photoelectric filter spectroradiometer suggests that repeated spectral energy measurements of solar simulators by using the monochromator method is not always essential. After the spectral irradiance of the solar simulator has been determined by the prism spectroradiometer, a simple photoelectric filter setup can be used as the sole instrumentation for periodic checking of the irradiance at as many wavelengths as desired. S.P.

N67-12956# Bureau of Mines, Denver, Colo. Mining Research Center.
EFFECT OF CHARGE DIAMETER ON EXPLOSIVE PERFORMANCE
Harry R. Nicholls and Wilbur Irving Duvall 1966 26 p refs
(BM-RI-6806)

The effect of varying the diameter of explosive charges on the generation and propagation of strain waves is studied. The parameters compared were strain amplitude, impulse, energy, and pulse shape. Three different explosives were detonated in three different charge diameters. Charges of cast 50/50 pentolite-detonated at the same velocity in 5-, 2.5-, and 1.5-inch diameters. Charges of ammonium nitrate–fuel oil prills and 45-percent semigelatin dynamite showed a strong detonation rate-diameter dependency. Detonation of these two explosives was considered nonideal. Differences in the diameter of the charge caused less difference in the strain-generating abilities of pentolite than in those of the other two explosives. This was also true for impulse and energy. Rise and fall times of the strain pulses for all three explosives were proportional to detonation time and cavity volume, respectively. Author

N67-13024*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.
LIGHT REFLECTION FROM ROUGH SURFACES
V. K. Polyanskiy and V. P. Rvachev Redstone Arsenal, Ala., Redstone Sci. Inform. Center, Sep. 1966 17 p refs Transl. into ENGLISH from Opt. i Spektroskopiya (Moscow), v. 20, no. 4, 1966 p 701–708
(NASA-TM-X-59178; RSIC-588) CFSTI: HC $1.00/MF $0.50 CSCL 20F

The effect of the scattering of polarized light by a dull dielectric surface has been studied. The zeroth diffraction approximation proves to be more detailed than does the ray-optics approximation. In such an approximation, we must repeatedly explain the fact of light depolarization and the dependence of polarization effects upon the scattering conditions and also the displacement of the maximum of the scattering curve for larger observation angles. Author

N67-13038# State Univ. of New York at Buffalo. School of Engineering.
DIFFRACTION OF PULSES BY OBSTACLES OF ARBITRARY SHAPE WITH A ROBIN BOUNDARY CONDITION: $\Phi + K \delta\Phi/\delta n = 0$. PART B: SEMI-FREE CASE; K<1
Richard P. Shaw Apr. 1966 43 p refs
(Contract Nonr-4449(00))
(Rept.-12; AD-636532) CFSTI: HC $2.00/MF $0.50

The velocity field resulting from the diffraction of a plane acoustic wave by a scattering obstacle of arbitrary shape with a Robin boundary condition, is found as the solution to an integro-differential equation. Numerical values are found for the velocity on the surface of a long cylinder of square cross section struck longitudinally by a plane pulse through an approximation of the integral by finite summations over specified steps in space and time. Comparison with exact solutions available for certain regions of space-time indicate good agreement. The solution for small values of K does not differ greatly from that for K = 0 indicating that the free boundary condition is a reasonable approximation for many physical problems. Values of K up to 1.0 (in appropriate nondimensional form) seem to give most reasonable results in terms of velocity; for K>10 a formulation in terms of pressure seems more appropriate and for values 1>K>10 either form will do. Author (TAB)

N67-13061# Advisory Group for Aerospace Research and Development, Paris (France).
OPTOELECTRONIC COMPONENTS AND DEVICES
Sep. 1965 461 p refs Proc. of the 9th Meeting of the AGARD Avionics Panel, Held in Paris, 6–9 Sep. 1965
(AGARD-CP-5) CFSTI: HC $5.11/MF $2.00

Articles on electro-optical devices and techniques in communications, instrumentation, guidance, radar, and other areas of application are presented. For individual titles see N67-13062–N67-13084.

N67-13072# Advisory Group for Aerospace Research and Development, Paris (France).
MODULATION OF COHERENT OPTICAL SIGNALS BY FRANZ-KELDYSH EFFECT DEVICES
Barry T. French *In its* Optoelectron. Components and Devices Sep. 1965 p 213–235 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

A necessary requirement for the introduction of optical spatial filtering techniques into real-time data processing systems is an electronically controllable transparency. Such a device must predictably attenuate coherent optical signals without deleterious alteration of relative phase. The most promising physical effect for this application appears to be the Franz–Keldysh effect, wherein the optical absorption coefficient of a direct semi-conductor material is altered by the application of an electric field to the material. Several planar devices have been designed and fabricated for use as light modulators and elements of optical function generators. Their design and subsequent evaluation as high speed optical intensity modulators are discussed with respect to transient response, passive and active damage to coherence, modulation range and optical and electrical efficiency. Projected methods of utilizing these devices to provide displays of some real continuous functions of one or two variables also are described. Author

N67-13073# Perkin-Elmer Corp., Norwalk, Conn.
COHERENT OPTICAL SIGNAL PROCESSORS
Eugene C. La Vier *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 237–249 refs (See N67-13061 03-23) CFSTI: HC $5.11/MF $2.00

A coherent optical signal processor is an electro-optic device that makes use of coherent sources and diffraction phenomena to

perform filtering, multiplication, spectral analysis, and combinations of these to do autocorrelation, and cross-correlation. Optical signal processors have two essential advatnages; the optical system is by its nature two-dimensional, and extremely high processing gain is possible due to high resolution capability of diffraction limited optics. The implications of these advantages on performance as related to several applications, are discussed. An optical processor consists of a laser, collimating optics, an input signal transducer, and additional optics for transforming the spatially distributed signal into its Fourier transform and imaging this on a reference plane and for collecting the signal for the output transducer. The effect of each of these elements on the processor performance is discussed, along with the practical level of performance that may presently be expected from these elements. Several possible applications of optical signal processors are included. Author

N67-13075# Defence Research Telecommunications Establishment, Ottawa (Ontario).

LIGHT BEAM SCANNING BY OPTICAL SIGNAL PROCESSING TECHNIQUES

G. W. Jull *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 275–294 refs (See N67-13061 03-23) CFSTI: HC$5.11/MF$2.00

This paper describes the principles of a new method for non-mechanical scanning of a light beam using optical signal processing techniques. A linear frequency modulated waveform applied to an ultrasonic light modulator can be used to form a time-varying diffraction grating. Light diffracted through this grating is filtered and subsequently rediffracted by a second grating to form an image at an angle determined by the difference in frequency between the two gratings at the particular time. Calculations for a particular selection of optical components are used to show that the first order image can be linearly scanned across 300 resolvable angles with a total angular deflection of 2.5 milliradians in a period of 200 microseconds. This method of forming a phased array at light wavelengths may have application for line-by-line, sequential readout of spatially-varying signals stored on photographic transparencies. A method is suggested for transmission of signals between two spatial planes by sequential readout, transmission and display of the Fourier spectrum of the signal. Author

N67-13077# Pacific Missile Range, Point Mugu, Calif.

UNCONVENTIONAL OPTICS FOR ELECTRONIC GUIDANCE SYSTEMS

W. A. Bowen, Jr. *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 305–312 *ref* (See N67-13061 03-23) CFSTI: HC$5.11/MF$2.00

Modern optoelectronic guidance systems, including pointing and homing functions, have generally evolved by utilizing the best of the astronomical telescope makers art. Essentially, use is made of a high quality undistorted image field, which is modulated and detected in a manner to supply serial electronic signals to be processed for information and control purposes. Certain geometric and sensitivity advantages may accrue from optoelectronic systems in which distorted rather than undistorted image fields are utilized. Distortions involving multi-valued transformations from the object to the image field call for novel but realizable modulating schemes. Two types of distorted field systems will be considered; one, a system in which points in the object field are converted to rings after focusing in the image field; second, a system that utilizes the critical angle between refractive media for fine angular resolution. Modulation schemes for each of the systems are introduced and alternatives are suggested. Extension of the simple embodiments to missile and space applications will be discussed subject to the limitations imposed by classification. Author

N67-13083# Compagnie Generale de Telegraphie sans Fil, Puteaux (France).

OPTIMIZATION OF TRANSMITTING AND RECEIVING COMPONENTS OF A TRANSMISSION SYSTEM BY NONCOHERENT INFRARED EMITTER DIODE [OPTIMISATION DES ORGANES EMETTEUR ET RECEPTEUR D'UN SYSTEME DE TRANSMISSION PAR DIODE EMETTRICE D'INFRAROUGE NON COHERENT]

P. Leclerc and D. J. Roulston *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 419–431 refs In FRENCH; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais (See N67-13061 03-23 CFSTI: HC$5.11/MF$2.00

A description is given of an operational emitter which can be used for the transmission of information at medium ranges and which required solution of the following three problems: (1) The adaptation of an optic capable of emitting the maximum light signal created in the emitter diode, in as weak a field as possible; (2) The cooling, by electrical means, e.g. Peltier effect, of the emitter diode to increase the efficiency of the latter; and (3) The modulation of the emitter diode, which is a low impedance component–less than 1 ohm–capable of being modulated to several hundreds of Mc/s. These three points require the optic, the diode, and a cathodyne transistor to be located near each other. The power which can be dissipated by the Peltier effect is small; the emitter diode must therefore be coupled thermally only to the Peltier element. A description of the emitter optimising these data, and the characteristics obtained, are given. Author

N67-13231#, National Lead Co. of Ohio, Cincinnati.

PAPERS PRESENTED AT THE X-RAY PREFERRED ORIENTATION MEETING HELD AT NATIONAL LEAD COMPANY OF OHIO, DECEMBER 5 AND 6, 1963

John W. Colby, ed. 15 Dec. 1965 110 p refs
(Contract AT(30-1)-1156)
(NLCO-946; Conf-631205) CFSTI: HC $4.00/MF $0.75

CONTENTS:

1. THE INVERSION OF POLE FIGURES FOR MATERIALS HAVING ORTHORHOMBIC SYMMETRY Peter R. Morris p 9–62 refs

2. GENERAL FORM OF THE SECOND ORDER TENSOR FOR PREDICTING PHYSICAL PROPERTIES IN ORIENTED MATERIALS E. F. Sturcken and J. W. Croach (E. I. du Pont de Nemour Co., Inc.) p 63–68 refs

3. TENSOR PROPERTIES OF ORIENTED METALS E. F. Sturcken and J. W. Croach (E. I. du Pont de Nemour Co., Inc.) p 69–78 refs

4. THE EFFECT OF PREFERRED ORIENTATION AND STRESS ON THE DIRECTIONAL PRECIPITATION OF HYDRIDES IN ZIRCALOY P. L. Rittenhouse and M. L. Picklesimer (Oak Ridge Natl. Lab.) p 79–102 refs

5. HEAT TREATMENT OF EXPERIMENTAL INGOT ALLOYS J. W. Starbuck (Mallinckrodt Chemical Works) p 103–106

6. MEASUREMENT OF ORIENTATION IN EXTRUDED BeO L. H. Sjodahl and S. F. Bartram (GE) p 107–117 refs

N67-13330# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

STUDY OF THE OPTICAL PROPERTIES OF A STRONG FOCUSING MAGNET (SACERDOTI-TAU TYPE) [STUDIO DELLE PROPRIETA' OTTICHE DIUN MAGNETE A FOCHEGGIAMENTO FORTE (TIPO SACERDOTI-TAU)]

B. Borgia (Rome Univ.), P. Joos (DESY), and M. Grilli 21 Mar. 1966 41 p refs In ITALIAN
(LNF-66/15)

Magnetic and optical measurements were made of a strong-focusing magnet of the Sacerdoti-Tau type. The principal parameters of the magnet are tabulated. The B field was measured

at various points along the principal trajectory and along the radial directions for various excitation currents of the magnet. The field index and the disperse field at the boundary were determined. The optical measurements were made with the wire method and the α method. The magnet constant, dispersion, resolving power, and focal distance were calculated from the measurement results. NSA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N67-12365# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE VARIATIONAL METHOD FOR CALCULATION OF THE MAGNETIC SUSCEPTIBILITY OF MOLECULES
T. K. Rebane *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 7–14 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

The field of applicability of a variational method for calculating molecular diamagnetic susceptibility is investigated. Formulas are derived for the ground, nodeless state, and for the magnetic susceptibility of an electron, describing the nodeless wave function and mean values of the squares of electron coordinates. It was found that the method investigated is not valid in cases where the electron wave function possesses nodal planes (as in the case of π-bonds). It is considered applicable only in cases of the short σ-bonds, the electron clouds of which are almost spherical. R.Li.

N67-12366# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PAIRED CORRELATIONS OF ELECTRONS IN THE THEORY OF MANY-ELECTRON SYSTEMS, I
L. N. Labsovsky *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 15–29 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

For describing the pair correlations of electrons in the many-electron systems, a method of reducing the many particle problem to the two-particle problem is developed. Instead of the wave function, one-particle and two-particle density matrixes are used. In the process of deriving an equation for the two-particle wave function, which describes a pair of electrons in the field of the others, a transition to the second quantization representation is accomplished. The perturbation theory aids in the solution of the obtained equation. R.Li.

N67-12382# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF CORRELATION ENERGY OF A MANY-ELECTRON SYSTEM BY THE VARIATION METHOD
L. N. Labzovskiy *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 202–207 refs (See N67-12364 03-06) CFSTI: HC $6.00/MF $1.25

A method for calculating pair correlation energies of electrons in a multi-electron system is described. The method is based on a variational principle. The calculation of correlation energies of 1s–1s and 1s–2s pairs in the lithium atom is presented as an example. S.P.

N67-12541# India. Dept. of Atomic Energy, Bombay.
PROCEEDINGS OF THE NUCLEAR PHYSICS AND SOLID STATE PHYSICS SYMPOSIUM. NUCLEAR PHYSICS
C. Badrinathan, ed. 1966 433 p refs Symp. held in Bombay, 21–25 Feb. 1966
CFSTI: HC $7.32/MF $2.00

Symposium papers on fission, cross-section measurement, elastic scattering, decay, directional correlation, reactor components, and other aspects of nuclear physics are presented. For individual titles see N67-12542–N67-12622.

N67-12542# India. Dept. of Atomic Energy, Bombay.
RECENT PROGRESS IN FISSION PHYSICS
R. Ramanna *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 1–27 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Some technological developments in nuclear physics are outlined: spontaneous fission, angular distribution of fission fragments and saddle states, fragment mass distribution and the stochastic theory of fission, and time of fission. Mathematical expressions are presented where applicable. R.Li.

N67-12543# India. Dept. of Atomic Energy, Bombay.
THERMAL NEUTRON INDUCED FISSION OF ^{229}Th
R. Zaghloul *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 28–32 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Thermal neutron induced fission of ^{229}Th, which is obtained by chemical separation from its parent nucleus ^{233}U, was carried out in a reactor. Samples of ^{233}U were eluted from a column in three purification cycles and thereby pure ^{229}Th, necessary for fission studies, was obtained. Figures depict the shift in the ^{229}Th spectrum towards the higher energy, with a low energy tail, and also the block diagram for the measurement of the kinetic energy and mass distribution. R.Li.

N67-12544# Indian Inst. of Tech., Kandur.
^{239}Pu TERNARY FISSION IN THE RESONANCE REGION
G. K. Mehta and E. Melkonian (Columbia Univ., N. Y.) *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 33–37 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Ternary-alpha studies of the fission process in the S-wave neutron induced fission, ranging from cadmium cut-off point to a few KeV, where two spin states are involved, are reported. An experiment is reported in which a synchrocyclotron was used as a pulsed neutron source, with measurements made of ^{239}Pu sources using a 10.5 meter flight path, as a function of neutron time-of-flight. It is indicated that ternary fission probability varies from resonance to resonance, and that grouping according to the two spin states is possible. R.Li.

N67-12545# India. Dept. of Atomic Energy, Bombay.
ANGULAR DISTRIBUTION OF FISSION FRAGMENTS IN BINARY AND TERNARY FISSION OF ^{236}U INDUCED BY 3 MeV NEUTRONS
D. M. Nadkarni *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 38–42 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

For a comparison with earlier experimental results on ternary fission, the angular distributions of binary and ternary fission fragments in the fission of the compound nucleus ^{236}U (produced by bombarding ^{235}U with 3 MeV neutrons) were measured. A description and schematic diagram of the experimental set up are given. A graphical presentation is made of the grid pulse distribution of binary and ternary fission fragments for a selected region of collector pulse height in thermal neutron 3 MeV neutron-induced fission of ^{235}U. It is reported that the measured anisotropy of binary fission fragments in 3 MeV neutron fission agrees with other methods. These preliminary results show that the angular distribution of ternary fission fragments in thermal neutron fission is isotropic whereas that in 3 MeV fission peaks at 90°. In thermal neutron

ternary fission, the isotropic angular distribution of fission fragments is due to the isotropic distribution of long-range alpha particles. R.Li.

N67-12546# Tata Inst. of Fundamental Research, Bombay (India).
STATISTICAL THEORIES OF THE NUCLEAR CROSS SECTIONS
Nazakat Ullah *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 43–55 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The statistical theory is applied to study the average properties and fluctuations of the nuclear collision cross-section. Ericson's theory of fluctuations in cross-sections, employing the scattering S-matrix, makes some simplifying assumptions about the distribution of the width amplitudes. The statistical collision matrix, using the random matrix hypothesis, is also briefly described. It was found that there is a very pronounced dependence of the fluctuations on the number of degrees of given freedom, as predicted by the theory. If the value of the width predicted by the statistical model is used, then the average spacing of energy levels can also be obtained, as well as information about the parity and spin of the residual nucleus. R.Li.

N67-12547# Saha Inst. of Nuclear Physics, Calcutta (India).
ANGULAR DISTRIBUTION STUDY OF $^{14}N(n,\alpha)^{11}B$ REACTIONS AT 14 MeV
M. L. Chatterjee *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 56–59 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The importance of direct reaction mechanism is seen from studies on the neutron-alpha particle reaction in light nuclei, and an attempt is made to study the trends of $\sigma(\Theta)$ variation for the states of ^{11}B near 0.0, 2.50, and 4.0 MeV excitations. Experimental details and an analysis is presented for $^{14}N(n,\alpha)^{11}B$ reaction study using bare Ilford K2 plates as a target, and 14.5 MeV neutrons as projectiles. From the theoretical fits to the angular distributions, it appears that the heavy-particle stripping mechanism is of importance for the reaction considered. However, it is considered that, in the calculations of the theoretical fits, a plane wave Born approximation with zero range interaction was used which might have led to an oversimplification of the whole mechanism. R.Li.

N67-12548# Tata Inst. of Fundamental Research, Bombay (India).
MEASUREMENTS OF 14 MeV NEUTRON INDUCED REACTION CROSS-SECTIONS USING ENRICHED ISOTOPES OF CALCIUM
P. N. Tiwari and E. Kondaiah *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 60–64 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Apart from the longer period of irradiation and counting, in order to be able to measure small reaction cross-sections by the activation method, the following things were done: large material was used in gamma counting, the efficiency of detection was increased, and a specially shielded gamma counting system was used. Formulas are given for the effective total as well as the photopeak efficiencies in the case of gamma rays in cascade using the measured monoergic efficiencies. The gamma-ray spectrum and half lives of the produced activities were measured and found to be in agreement with previous measurements. In those cases where the reaction leads to an isomeric state that decays to the ground state which further decays by beta emission, a formula is derived to calculate the ground state cross-section from ground state activity. A cross-section table details the reaction studied material used, and isotope enrichment for theoretical and experimental results. R.Li.

N67-12549# Bose Research Inst., Calcutta (India).
MEASUREMENT OF THE ABSOLUTE (n,2n) CROSS SECTION OF LOW Z NUCLEI FOR 14.8 MeV NEUTRONS
Arun Chatterjee, B. Mitra, and A. M. Ghose *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 66–68 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A few absolute values of (n,2n) cross sections for 14.8 MeV neutrons are reported. Absolute cross sections were obtained by measuring the absolute value of the neutron flux used for irradiation and the absolute of the resultant positron activity; the neutron flux was measured by means of a heavily biased plastic scintillator. The flux measured by this method gives directly the value of the neutron flux incident on the sample and is free from errors caused by scattering in the target material, holders, etc., present between the tritium target and the sample. To keep the incident neutron energy constant, deuteron energy in the t–d accelerator was kept at 130 KeV and the samples were irradiated in the forward direction in a well defined geometry; the neutron energy was thus limited within the range of 14.8±0.1 MeV. Tabular data show preliminary laboratory results compared with values obtained by other means. The errors in the cross sections reported are within ±10%. R.Li.

N67-12550# Bose Research Inst., Calcutta (India).
MEASUREMENT OF NONELASTIC CROSS SECTIONS OF NUCLEI FOR FAST NEUTRONS
Arun Chatterjee and A. M. Ghose *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 69–73 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The development of a new method to measure the nonelastic cross section without requiring any knowledge of other cross sections is reported. The experimental arrangement and the detector, a plastic scintillator connected to a conventional photomultiplier, analyser system, are described. Tabular data show the values of the nonelastic cross section in barns/nucleus obtained for 14.8±0.1 MeV neutrons. For comparison, the values obtained by previous investigations using neutrons in the 14 MeV range are shown in tabular form. If the trend of cross sections in this energy range is taken into account, the results are apparently in excellent agreement with previous studies. It is therefore concluded that the present method is quite justified to be used for fast neutrons. R.Li.

N67-12551# Punjab Univ., Chandigarh (India). Dept. of Physics.
(N,2N) CROSS SECTIONS AND ISOMERIC RATIOS AT 14.8 MEV
C. S. Khurana and S. K. Mangal *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 74 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A neutron cross section and isomeric ratios at 14.8 MeV were measured for ^{113}In and ^{92}Mo target nuclei using a NaI scintillation spectrometer. Theoretical calculated isomeric ratios were compared with measured values to find the value for the spin distribution parameter. R.Li.

N67-12552# Kurukshetra Univ. (India).
RESONANCE SCATTERING OF THERMAL NEUTRON CAPTURE GAMMA RAYS
H. S. Hans *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 75–79 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Reviewed are studies on accidental nuclear resonance, and nuclear resonance due to the effect of the preceding transitions. Tabular data show the effective cross sections of target-scatter combinations for which such accidential resonance scattering was

observed. A method of nuclear resonance scattering of capture gamma rays made possible due to the preceding transitions developed in the laboratory is reported. R.L.I.

N67-12553# India. Dept. of Atomic Energy, Bombay.
FLUCTUATION ANALYSIS OF ^{27}Al $(P,\alpha_0)^{24}$Mg AND ^{27}Al $(P,P_3)^{27}$Al* CROSS SECTIONS
M. K. Mehta and A. S. Divatia *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 80–83 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Energy excitation curves were expressed for the reactions ^{27}Al$(p,\alpha_0)^{24}$Mg and ^{27}Al$(p,p_3)^{27}$Al*, and calculated for the averaging interval ranging from 20 to 1500 KeV. The fluctuation theory, which gives useful information about the reaction mechanism and the average life time of the compound nucleus, is used to analyze the excitation curves. It is indicated that, besides the contribution due to fluctuations, the average structure shown by the three excitation curves represents resonance effects due to separate but interfering levels in the compound nucleus ^{28}Si. R.L.I.

N67-12554# Tata Inst. of Fundamental Research, Bombay (India).
MECHANISM OF THE ^{51}V(p,n)^{51}Cr REACTION
K. V. K. Iyengar, S. K. Gupta, and B. Lal *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 84–88 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

To compare experimental results with calculated correlations for information on the reaction mechanism, the measurement of the n-γ correlations in a ^{51}V(p,nγ)^{51}Cr reaction was undertaken. Excitation curves of 0.75 and 1.17 MeV gamma rays from ^{51}V(p,n)^{51}Cr* are presented graphically and exhibit no prominent structure. The n-γ angular correlation at each setting of the neutron detectors was measured more than once to improve statistical accuracy. They were found symmetric at certain neutron detection angles, and in some cases also isotropic. The angular correlations at supplementary neutron angles at times exhibit similarity of shape as required by the compound nucleus reaction mechanism. R.L.I.

N67-12555# India. Dept. of Atomic Energy, Bombay.
PROTON INDUCED REACTIONS ON ^{51}V
N. Sarma, V. K. Deshpande, G. K. Mehta (Indian Inst. of Tech., Kanpur), and D. K. Sood *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 89–92 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The excitation functions of protons scattered from vanadium are reported. To study proton induced reactions ^{51}V was chosen. The analysis procedure consisted in obtaining excitation curves in different channels at different angles and obtaining correlation functions from these curves to determine whether the compound nucleus is excited to the continuum region. The spectrum of the reaction products at 210° for 4.1 MeV is shown graphically, and it is noted that the ground state alpha group from vanadium lies outside the range shown. Prominent peaks corresponding to elastic scattering from tantalum, vanadium, oxygen, and carbon can be seen. The reaction peaks of α_1 and p_1 from vanadium are an order of magnitude smaller. Also shown are the excitation curves in the scattering channel, at two angles. R.L.I.

N67-12556# India. Dept. of Atomic Energy, Bombay.
STUDY OF ^{13}C$(\alpha,n)^{16}$O AND ^{51}V$(p,n)^{51}$Cr REACTIONS
K. K. Sekharan, A. S. Divatia, M. K. Mehta, and S. S. Kerekatte *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 93–97 ref (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The integrated cross section of the ^{13}C$(\alpha,n)^{16}$O reaction was determined for the incident alpha particle energy range of 1.95 to 5.5 MeV by bombarding an enriched ^{13}C target on tantalum backing, and is depicted graphically. The integrated cross section of the ^{51}V$(p,n)^{51}$Cr reaction is also graphed for the energy region 1.9 to 5.5 Mev, and experimental details are similar to the described reaction. In the investigation of these reactions, it is indicated that the reaction contributing mainly to the total cross section of protons on vanadium is the (p,n) reaction. Other energetically possible reactions, such as proton inelastic scattering, (p,γ), and (p,α) reactions are considered as well as the (p,p'), but it is pointed out that all these reaction cross sections added together form only a fraction of the total reaction cross section. Thus, if the (p,n) cross section is determined accurately, the total reaction cross section can be obtained enabling a comparison to be made between the experimental values and those calculated on the basis of the optical model. R.L.I.

N67-12557# Punjab Univ., Chandigarh (India).
STATES IN $^{56}Fe_{30}$ EXCITED BY THE (p,pγ) REACTION
P. N. Trehan, N. C. Singhal, P. C. Mangal, and D. M. Van Patter (Bartol Res. Found.) *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 98–103 refs Prepared in cooperation with Bartol Res. Found. Sponsored by AFOSR and Natl. Bur. of Standards (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

To measure the yields of the (p,p'γ) radiations from $^{56}Fe_{30}$ targets for proton bombarding energies ranging from 4.8 MeV to 5.95 MeV, gamma spectrum measurements were made. The gamma ray spectrum is depicted, as well as the level scheme of $^{56}Fe_{30}$ consistent with the gamma rays. Various gamma ray energy levels are mentioned; a ground state transition is reported. To get some idea about the spin assignment to certain levels, the production cross section was obtained from experimental yields of various gamma rays. Comparisons are made between experimental and theoretical cross sections. Tabular data list spin, parity, and parent MeV levels, for level cross sections in M_b for three values of E_p. R.L.I.

N67-12558# Saha Inst. of Nuclear Physics, Calcutta (India).
STUDY OF NUCLEON CORRELATION WITH TWO PARTICLE STRIPPING REACTION
Paresh Mukherjee *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 104–109 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Reactions involving the simultaneous transfer of two nucleons are explored, and some important findings in the two particle transfer reactions are briefly described. Using pairing model wave functions, some useful expressions for cross sections of two particle transfer reactions are reviewed. An example is presented in which the possibility of detecting a very small admixture of higher order configurations in the ground state wave function of even–even nuclei is clearly indicated. The preferential excitation of certain isobaric spin states is indicated. The possibility of determining the phases of the different components of the nuclear wave function is shown. This indicates that the two nucleon transfer reaction can be used, along with the single nucleon stripping reaction, to derive in detail the wave functions of those states which are strongly mixed in configuration. R.L.I.

N67-12559# India. Dept. of Atomic Energy, Bombay.
THE TWO-NUCLEON STRIPPING REACTION, ^{40}Ca(^{3}He, p)^{42}Sc
B. K. Jain and N. Sarma *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 110–113 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A modified zero-range approximation in the distorted wave formalism was used to obtain differential cross section of (^{3}He,p) reactions, in particular the ^{40}Ca(^{3}He,p)^{42}Sc two-nucleon stripping reaction. The transition matrix element for the reaction is reported, and the differential cross section given in terms of this matrix

element. The calculations were programmed for the CDC-3600 computer. The optical model parameters for ^{3}He and protons on ^{40}Ca and ^{42}Sc were not available, but the effect of varying the parameters was investigated, and the best fit to the experimental data shown in tabular form. R.Li.

N67-12560# India. Dept. of Atomic Energy, Bombay.
SPINS OF THE FIRST TWO EXCITED STATES IN ^{27}Mg BY PROTON GAMMA RAY ANGULAR CORRELATION MEASUREMENTS IN THE REACTION $^{26}Mg(d,p\gamma)^{27}Mg$
M. A. Eswaran *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 114–119 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The first two excited states of ^{27}Mg at 0.98 and 1.69 MeV were studied by proton–gamma ray angular correlation measurements in the reaction $^{26}Mg(d,p\gamma)^{27}Mg$ employing a method in which the analysis is independent of any assumption regarding the reaction mechanism. From the (d,p) reaction angular distribution studies, the angular momentum values of captured neutron are given as 2 for both the first and second excited states in ^{27}Mg implying positive parity and spin values of 3/2 or 5/2 for both states. As shown by the method reviewed, if the outgoing particles are detected at 0° with respect to the beam in a small axially symmetric detector, and the correlation of subsequent de-excitation gamma ray from the excited state in the residual nucleus is measured, then the magnetic substrates which can be populated in the excited states are limited by the sum of the spins of target nucleus, bombarding and outgoing particles. Accordingly, in the reaction $^{26}Mg(d,p\gamma)^{27}Mg$ only the 1/2 and 3/2 substates are populated in the state excited in ^{27}Mg. R.Li.

N67-12561# India. Dept. of Atomic Energy, Bombay.
ELASTIC SCATTERING OF ALPHA PARTICLES BY ^{24}Mg
S. S. Kerekatte, M. K. Mehta, A. S. Divatia, and K. K. Sekharan *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 120–122 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

With a view to studying the energy levels in ^{28}Si, a study of the elastic scattering of alpha particles by ^{24}Mg was undertaken. Alpha particles elastically scattered from ^{24}Mg were observed at the laboratory angles of 80.5° and 164° for incident alpha particle energies from 3.440 to 5.5500 MeV, and the corresponding excitation energies in the compound nucleus ^{28}Si listed. R.Li.

N67-12562# India. Dept. of Atomic Energy, Bombay.
ELASTIC SCATTERING OF ALPHA PARTICLES FROM ^{6}Li
D. K. Sathe (Tata Inst. of Fundamental Res.), K. B. Nambiar, A. S. Divatia, and M. K. Mehta *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 123–126 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Levels in ^{10}B lying between 5.92 MeV and 7.01 MeV were investigated by studying the elastic scattering of alpha particles from ^{6}Li for incident alpha particle energies from 2.4 to 4.5 MeV. Thin targets of ^{6}Li deposited on carbon film were bombarded with singly charged helium ions; elastically scattered alpha particles were observed using solid state detectors. Pulses from the detectors were amplified and fed into a TMC 400 channel analyzer; a typical spectrum obtained is shown. R.Li.

N67-12563# Tata Inst. of Fundamental Research, Bombay (India).
^{7}Li AND ALPHA PARTICLES FROM THE $^{6}Li+^{9}Be$ REACTION
Baldev Sahai *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 127 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The kinetic energy spectra of ^{7}Li nuclei and alpha particles formed as a result of the nuclear reaction between ^{6}Li projectiles and certain ^{9}Be targets were studied by a particle selection system using a gas proportional counter with a very thin window and solid-state detectors to measure the energy. Also mentioned are the abeolute differential cross-sections for the four highest alpha groups from the concomitant reaction $^{9}Be(^{6}Li,\alpha)^{11}$. R.Li.

N67-12564# Tata Inst. of Fundamental Research, Bombay (India).
UNDERSTANDING OF SOME PROBLEMS IN NUCLEAR PHYSICS FROM A STUDY OF HYPERNUCLEI
K. N. Chaudhari, S. N. Ganguli, N. K. Rao, and M. S. Swami *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 128–131 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The bound state for the short-lived lambda hyperon (Λ°) is discussed. Using high energy pions and proton beam, the production of hypernuclei in nuclear emulsion was studied. The decay characteristics of some of the light hypernuclei are discussed to show the relationship between nuclear physics and hypernuclear physics. Also mentioned are the effects of final state interaction in these hypernuclear decays. R.Li.

N67-12565# Delhi Univ. (India).
THREE-BODY SYSTEMS THROUGH FACTORABLE POTENTIALS
A. N. Mitra *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 132–139 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The main features of the three-body equations are briefly mentioned in relation to factorable potentials. The method outlined is considered suitable to study hypernuclear data, especially binding energies. An application of the technique indicated is the example of a physical process which may be idealized as a three-body process, and amenable to an exact solution against which the results of standard approximations may be tested. R.Li.

N67-12566# Physical Research Lab., Ahmedabad (India).
SURFACE DELTA-INTERACTION AND ^{40}K
M. S. Shah and S. P. Pandya *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 140–144 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

In studying the observed features of nuclear spectra, such as rotations or vibrational spectra, the surface delta-interaction as an effective force between nucleons in nuclei is reviewed. The spectrum of ^{40}K is recalculated using the delta-interaction, but leaving the radial integrals as free parameters. A better fit to the observed spectrum is obtained as compared to the conventional delta-interaction, and an investigation is made of the radial integrals' ability to support the surface delta-interaction model. Among other calculations, that for a normal delta-interaction following the described procedure, is outlined. R.Li.

N67-12567# Physical Research Lab., Ahmedabad (India).
ENERGY LEVELS OF $^{140}La_{57}$ AND $^{146}Eu_{63}$
M. S. Shah, S. P. Pandya, and K. H. Bhatt *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 145 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The energy levels of the $^{140}La_{57}$ and the $^{146}Eu_{63}$ are calculated using the δ-function or quadrupole–quadrupole interaction between the odd proton and neutron. Reasonable agreement with the observed spectrum of ^{140}Eu is obtained for quadrupole–quadrupole interaction. R.Li.

N67-12568# Tata Inst. of Fundamental Research, Bombay (India).
ON AN EFFECTIVE RESIDUAL INTERACTION FOR SHELL MODEL CALCULATIONS
V. R. Pandharipande *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 146–149 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

An interaction which can reproduce spectra using simple configurations, and its application to calculate the spectra in ^{116}Sn are reported. The total angular momentum of the two particles is designated, and the matrix elements of the interaction stated. Harmonic wave functions were used in calculating the radial integrals. The calculated values of the square root of the mean square radius for the outermost nucleon along with experimental values of the nuclear radius in fm's are tabulated. R.Li.

N67-12569# India. Dept. of Atomic Energy, Bombay.
THE QUADRUPOLE PLUS PAIRING FORCE FOR DEFORMED NUCLEI
M. R. Gunye and S. Dasgupta (Tata Inst. of Fundamental Res.) *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 150–155 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The validity is examined of certain basic approximations in calculations relating to the quadrupole plus pairing force theory for deformed nuclei. A Hamiltonian equation is derived in which the shell-model part, the strength of the pairing force, and the strength of the quadrupole force are shown. Emphasis is on the ground state problem, and only axially symmetric deformations are considered. Details are given on the Hartree–Fock–Bogoliubov calculations. It is stated that as a function of the number of particles, deformation appears or disappears suddenly. Tabular data show the absolute energy difference between the prolate and oblate minima. R.Li.

N67-12570# Allahabad Univ. (India).
INTEGRATED CROSS SECTION OF HELIUM WITH A VELOCITY-DEPENDENT POTENTIAL
B. K. Srivastava and S. C. Jain *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 156–160 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The integrated cross section σ_{int}, assuming the two-body forces to be central but velocity-dependent, is calculated for helium 4. Values obtained of the integrated cross section (MeV–mb) for ^4He are tabulated and compared with previous studies. Comparisons show that velocity-dependent forces increase the σ_{int} by about 17% for both the Serber and Rosenfeld mixtures; this is considered to be in reasonable agreement with previous results that show central velocity-dependent correlations increasing σ_{int} by 14% for nuclear matter. R.Li.

N67-12571# Punjab Univ., Chandigarh (India).
STUDY OF ^{18}O NUCLEAR SPECTRA WITH SOFT CORE POTENTIAL
N. Kumar, G. C. Agarwal, and V. B. Bhanot *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 161–165 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

An attempt was made to calculate the energy levels of ^{18}O by using a soft-core potential and selecting different values of the hardness parameter n. Contributions from only singlet s-state interactions are included since it has already been shown that the inclusion of only s-states can give good agreement for ^{18}O level spectrum. The effect of configuration interaction is included, and calculations were made by varying the hardness parameter n from 1 to 4. As n increases, the potential becomes steeper and reaches almost a hard core for large values. Results show that the soft-core pontential leads to energy level spectrum of ^{18}O which is in fairly good agreement with the experimental data. This potential is considered to have the important advantage that the calculations are much simpler as compared to other theoretical techniques employed. R.Li.

N67-12572# Andhra Univ., Waltair (India). Labs. for Nuclear Research.
PROPERTIES OF THE LOW ENERGY EXCITED STATES OF ^{197}Au
M. L. N. Raju and V. Lakshminarayana *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 166–169 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Systematic theoretical studies were made on the properties of low energy excited states of spherical nuclei. The energy states were treated as superpositions of different particle and particle plus phonon functions. The amplitudes of the different functions in the states of ^{197}Au are tabulated. Wave functions describing the low energy states were taken as particle and particle $3/2^+$ phonon functions. Prominent features of the wave functions discussed are shown. R.Li.

N67-12573# Punjab Univ., Chandigarh (India).
SEMI-EMPIRICAL TERMS IN NUCLEAR POTENTIALS
Naresh K. Sood and Santosh S. Bedi *In* Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 171–175 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

In an investigation of proton and neutron well depths of the proton potential anomaly, an attempt was made to study nuclei other than those lying on a β-stability line. The calculations were made for even-even isotopes of ^{50}Sn, ^{52}Te, and ^{42}Mo using a velocity dependent potential. To conform to experimental results, potential parameters are adjusted and the yields listed. The neutron and proton well depths and the anomalous potential required are tabulated for three sets of isotopes. The semi-empirical investigation is briefly outlined. R.Li.

N67-12574# Shri Govindram Seksaria Technological Inst., Indore (India).
MEASUREMENT OF ELECTRON–ELECTRON SCATTERING GROSS-SECTION USING A TRANSVERSE BETA-RAY SPECTROMETER
K. G. Bhatanagar, D. V. Bhawalkar, and M. R. Bhiday *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 176 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

To measure electron–electron scattering cross sections, a transverse beta ray spectrometer was used. Beta rays from ^{137}Cs were energy selected within $\pm 5\%$ by a velocity selector placed in a combined electric and magnetic field; the measurement technique is outlined. Corrections were applied to the experimental cross-section for (1) counting losses due to multiple scattering in the foil, (2) losses due to absorption in the aluminum foils covering the plastics, (3) non-uniformity of the magnetic field, and (4) effects of finite slit sizes. Results are compared with theoretical findings obtained for other relativistic cross sections. R.Li.

N67-12575# Tata Inst. of Fundamental Research, Bombay (India).
MAGNETIC MOMENTS OF VIBRATIONAL STATES IN EVEN-EVEN NUCLEI
S. K. Bhattacharjee *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 177–180 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

When investigating the gyromagnetic ratios of vibrational states, measurements of the hyperfine fields in nuclei in many dilute alloys of iron were utilized. Experimental values of the measured g_R-factors of known vibrational 2^+ states are plotted as a function of mass number A. Results indicate that the existing microscopic models of vibrations in spherical nuclei are inadequate to explain the observed g_R-values, and that there is need to perform detailed microscopic calculations in these regions which can account for the observed experimental values of the magnetic moments of the 2^+ excited states in near sphdrical nuclei. R.Li.

N67-12576# Tata Inst. of Fundamental Research, Bombay (India).
MAGNETIC MOMENT OF THE 280 KeV (5/2⁻) LEVEL IN ^{75}As
Y. K. Agarwal and C. V. K. Baba *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 181–183 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

An attempt was made to improve the accuracy of measurement of the magnetic moment of the 280 KeV (5/2⁻) level in ^{75}As. The 122–280 KeV γ-cascade was used to measure the magnetic moment of the 280 KeV state by an integral method. The directional correlation of this cascade was measured in the same geometry used for the g-factor measurements. The g-factor was measured by perturbing the directional correlation in an external magnetic field of 20 KG. The lifetime $\bar{C}$ of the 280 KeV state was calculated to extract the magnetic moment from the observed rotation. Also calculated was the effective spin g-factor $g_{s,eff}$ from the measured value of the magnetic moment. R.Ll.

N67-12577# Tata Inst. of Fundamental Research, Bombay (India).
BETA DECAY EXPERIMENTS AND PARITY OF ^{192}Ir
S. K. Bhattacherjee, H. C. Jain, S. K. Mitra, and H. C. Padhi *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 184–188 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Measurements were made on β–γ directional correlation in two cascades in the decay of ^{192}Ir 535 KeV β-group and the 605 KeV gamma ray, as well as the 670 KeV β-group and the 468 KeV γ-ray. The β–γ circular polarization in the latter cascade was also measured. The decay scheme is shown graphically. The β–γ directional correlation measurement in the first cascade with beta energy selected in the region 250 to 300 KeV shows a large anisotropy (−11±1)%. This leads to the conclusion that the parity of ^{192}Ir is negative and its ground state has the character 4⁻. The energy dependence of the anisotropy in an inner beta group, measured in the beta energy region 185 to 430 KeV, is plotted. It is stated that the strange behavior of the energy dependence probably indicates that some strange combination of matrix elements is responsible for this beta decay. R.Ll.

N67-12578# Tata Inst. of Fundamental Research, Bombay (India).
BETA GAMMA DIRECTIONAL AND CIRCULAR POLARIZATION CORRELATION IN ^{228}Ac
S. K. Bhattacherjee, K. S. Bhatki, D. C. Ephraim, H. C. Jain, S. K. Mitra et al *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 189–191 ref (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Described is an experiment dealing with a series of β–γ directional and circular polarization correlation measurements involving known levels in ^{228}Th at 966 KeV (I=2⁺) and 396 KeV (I=3⁻). Anisotropies are listed, and it is found that the parity of ^{228}Ac is negative. The spin assigned to ^{228}Ac is 3⁻. R.Ll.

N67-12579# Andhra Univ., Waltair (India).
BETA DECAY MATRIX ELEMENTS IN THE DECAY OF SILVER-111
V. Seshagiri Rao and V. Lakshminarayana *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 192–193 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Briefly mentioned is the decay of the ^{111}Ag isotope, and computer method to obtain beta decay matrix elements. Differential correlations were performed at give angles for beta particles, and the coefficients evaluated. Differential correlations at five energies are listed. R.Ll.

N67-12580# Delhi Univ. (India).
GAMMA–GAMMA DIRECTIONAL CORRELATIONS IN ^{144}Pr
S. L. Gupta and N. K. Saha *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 194–198 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Gamma–gamma directional correlation measurements in the 34–100 and 54–80 KeV cascades were undertaken to resolve some uncertainties in the level scheme of ^{144}Pr. All coincidence measurements were carried out using a conventional fast–slow coincidence spectrometer with an effective resolving time of ≈30 ns. The observed γ-ray spectrum coincident with the Pr K X-rays are graphed, as is the observed gamma spectrum coincident with the 80 KeV photopeak. The possibility was established of making an independent check of the ground state spin assignment of ^{144}Pr from the gamma–gamma directional correlation of the 43–80 KeV cascade only. R.Ll.

N67-12581# Delhi Univ. (India).
GAMMA–GAMMA DIRECTIONAL CORRELATIONS IN ^{187}Re
S. L. Gupta and M. M. Bajaj *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 199–203 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A reexamination of the spin assignments to the 208 and the 686 KeV levels was made by carrying out the directional correlation measurements for the 72–134 and the 552–134 KeV cascades in ^{187}Re. The solid angle corrected directional correlation function for both cascades were found, and certain interfering coincidences briefly outlined. Of the three possible spin values reviewed, the calculation described favors a spin value of 5/2 for the 686 KeV level. R.Ll.

N67-12582# Tata Inst. of Fundamental Research, Bombay (India).
LEVEL STRUCTURE OF ^{199}Au
K. G. Prasad, R. P. Sharma, and B. V. Thosar *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 204–208 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Energy levels of ^{199}Au were determined with the help of high-resolution lithium drifted germanium and surface barrier detectors. The gamma spectrum on the lithium drifted germanium detector is graphed, and the intensity of different gamma transitions normalized to a value of 100 for the 540 KeV transition is shown. The conversion line spectrum was studied on a p–n type surface barrier detector with a depletion layer of thickness 500 microns; a graph depicts the internal conversion lines corresponding to 187, 247, 318 and 544 KeV transition. It is considered that the level structure in ^{199}Au is more complex, and it is difficult to point out a simple core multiplet as in the case of ^{197}Au. R.Ll.

N67-12583# Saha Inst. of Nuclear Physics, Calcutta (India).
NIOBIUM-92 AND ENERGY LEVELS IN ZIRCONIUM-92
D. Basu, B. Sethi, and H. Bakhru *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 209–213 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

An investigation was undertaken to measure accurately the half-lives by which the intensities of various gamma rays decay so that discrepancies in previously reported values could be resolved, and more information about ^{92}Nb decay obtained. The beta-decay curves prepared show activities accounted for by 6.6 min ^{94}Nb and 64 hr ^{90}Y. The gamma ray spectrum of the activities produced after bombarding a niobium sample showed a short-lived activity, associated with three photopeaks. Summarized results of gamma–gamma coincidence experiments show measured cross sections for different reactions on niobium. R.Ll.

N67-12584# Saha Inst. of Nuclear Physics, Calcutta (India).
DECAY OF ^{174}Tm

S. C. Gujrathi and S. K. Mukherjee *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 214–217 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The decay of ^{174}Tm was investigated in more detail by using beta–gamma scintillation spectroscopic techniques. The ^{174}Tm sources were produced through (n,p) reaction by irradiating enriched ^{174}Yb, and the measured half-life showed good agreement with previous reports. The gamma spectrum taken with a 3" × 3" NaI(Tl) crystal is shown, and various photopeaks are clearly indicated. Summarized results of a number of beta–gamma and gamma–gamma coincidence experiments are presented in tabular form. R.Li.

N67-12585# Saha Inst. of Nuclear Physics, Calcutta (India).
THE DECAY OF ^{176}Tm AND THE ENERGY LEVELS OF ^{176}Yb

S. C. Gujrathi and S. K. Mukherjee *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 218–221 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Enriched ^{176}Yb (98%) was bombarded with 14.8 MeV neutrons, and the radioactive products studied. Only two half-lives were observed, confirming that the 4.1 d activity was due to ^{175}Yb. The short-lived activity of 1.4 min was assigned to ^{176}Tm by considering the similarity of the low energy gamma rays, along with their cascade relationship, with the gamma transitions of ^{176}Yb observed in Coulomb excitation. Summarized results are listed for a number of coincidence studies, as well as for measurements by an anthracene crystal. A proposed decay scheme of ^{176}Tm is shown. R.Li.

N67-12586# Saha Inst. of Nuclear Physics, Calcutta (India).
DECAY OF ^{76}Ga

B. Sethi and S. K. Mukherjee *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 222–223 (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

By irradiating enriched ^{76}Ge as well as natural germanium metal with 14 MeV neutrons, ^{76}Ga was produced; its half-life was found to be 42 sec. The beta spectrum of the irradiated enriched sample was measured with a plastic scintillator coupled to a photomultiplier. Beta groups with various end point energies were found to decay with a half-life of 42 sec, and the gamma spectrum of irradiated germanium samples showed gamma rays of varying intensities decaying at the same rate. Tabular results summarize various coincidence experiments. R.Li.

N67-12587# Saha Inst. of Nuclear Physics, Calcutta (India).
THE DECAY OF ^{164}Ho

B. Sethi and S. K. Mukherjee *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 224–227 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

In a reinvestigation of the decay properties of ^{164}Ho, samples were produced by irradiating natural holmium (Ho 165) with 14 MeV neutrons. The beta spectrum was taken with a lithium drifted silicon detector, and an analysis of the continuous spectrum showed two beta groups with their end point energies. The photon spectrum, taken with a NaI(Tl) scintillator, showed the presence of photons of energies 35, 48, 51, 72 and 90 KeV. The relative intensities of the beta groups and photons are tabulated. Decay curves for gamma rays of various energies and for betas are presented, and complex decay curves are exhibited. Tables show the cross-section and half-life for metastable and ground states, as well as calculated values for E2 multipolarity, and experimental values for two transitions. R.Li.

N67-12588# Tata Inst. of Fundamental Research, Bombay (India).
ENERGY LEVELS OF ^{149}PM

K. P. Gopinathan and R. M. Singru *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 228–233 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Further studies are reported on the energy levels beyond 654 KeV and the high resolution internal conversion, and gamma ray studies in ^{149}Pm from the decay of 1.8 hr ^{149}Nd. The gamma spectrum was studied by absorbing the low energy gamma rays by 1 cm lead + cadmium and copper, and showed certain weak gamma transitions. As studied by a Ge(li) solid state detector, the gamma spectrum gave further evidence for high energy transitions beyond 654 KeV. The relative intensities of gamma rays in ^{149}Nd decay are tabulated; results are summarized for internal conversion measurements in ^{149}Nd. R.Li.

N67-12589# Punjab Univ., Chandigarh (India).
ON THE DECAY OF ^{110}AG

S. P. Sud, P. C. Mangal, and P. N. Trehan *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 234–238 refs Sponsored by Natl. Bur. of Standards (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A modified technique was used to study the decay of ^{110m}Ag, and the results are discussed. The most recent decay scheme of ^{110m}Ag decaying to ^{110}Cd by negatron emission is seen, and a block diagram of the modified sum coincidence set up for this study is shown. Observed sum coincidence peaks, and possible cascades are tabulated for intense cascades in ^{110}Cd. Since all possible cascades which could lead to the observed spectrum are listed in this table, it is considered that the method outlined confirms all the existing cascades previously reported. An indication of a level at 2.72 MeV is also found from the single crystal sum spectrum of ^{110m}Ag. R.Li.

N67-12590# Delhi Univ. (India).
INTERNAL CONVERSION OF 57Fe GAMMA-RAYS

S. K. Suri and J. Varma (Udaipur Univ.) *In* India. Dept. of Atomic Energy Proc. of the Nucl Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 239–242 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The internal conversion coefficient of the 14.4 KeV gamma rays of ^{57}Fe were measured accurately by two independent nuclear spectroscopic methods. In one, the intensity of the K X-rays of ^{57}Fe is compared with that of the 14.4 KeV gamma rays, while in the other method, the intensities of the 14.4 KeV and the 122 KeV gamma rays are compared. A fast–slow coincidence arrangement with fast resolving time was used to measure the branching ratio of the 122 KeV transition; this branching ratio agrees with previously found values. The measured value of α_T is found to be in good agreement with the values of α_T reported by using nuclear spectroscopic methods, but is larger than those obtained from Mossbauer effect measurements. It is felt that this discrepancy can be attributed to the approximations in the crystal dynamics. R.Li.

N67-12591# Andhra Univ., Waltair (India).
SUM COINCIDENCE STUDIES OF THE DECAY SCHEMES of ^{182}Ta AND ^{131}Ba

V. Radhakrishnamurty and Swami Jnanananda *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 243–248 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Briefly reviewed are studies of sum coincidence of decay schemes of ^{182}Ta and ^{131}Ba. Two new gamma transitions at energies 146 and 351 KeV are mentioned. Sum coincidence spectra at various gate settings are shown. The various cascades observed in such spectra confirm the decay scheme previously reported, with the exception of 351 and 146 KeV transitions. For ^{131}Ba

decay, a number of new gamma transitions were proposed, and the decay scheme suggested contained a new level at 584 KeV. Sum coincidence spectrum is recorded at energy level 1046 KeV, and spectra at gate settings 923, 697, 620, and 585 KeV are also reported. The comprehensive level scheme constructed for ^{131}Cs fitting all the observed gamma lines is also depicted. R.Ll.

N67-12592# Punjab Univ., Chandigarh (India).
FRACTIONAL INTENSITIES IN THE DECAY OF ^{177}Lu AND ^{186}Re
V. Radhakrishnamurty and Swami Jnanananda (Andhra Univ.) *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 247–250 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The crossover and cascade fractional intensities in decay were determined experimentally for a thin and weak source of ^{177}Lu. The attenuation factors measured from the adder and the corresponding zero bias 4 π-sum peak coincidence spectra, for various peaks, are also tabulated. The ratio of the theoretical transition probabilities for two gamma rays to the same multipolarity is calculated from a strong coupling model formula. The ^{186}Re source, from which a fine powder is obtained with an activity of 50 mC, is allowed to decay for several days to minimize the ^{185}Re content; then the sum and zero bias sum peak coincidence spectra are recorded. From the measured value of the attenuation factor for the 768 KeV peak, the fractional intensities for cascade and crossover were found. R.Ll.

N67-12593# Andhra Univ. (India).
POLARISATION EFFECTS IN INELASTIC SCATTERING OF GAMMA RAYS
A. S. Raju, J. Rama Rao, and V. Lakshminarayana *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 251–254 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

In an investigation of the inelastic scattering of photons by free electrons, a 10 curie source of ^{137}Cs is used to improve statistical superiority by collecting the data in two different planes simultaneously. A sophisticated electronic system employing three scintillation detectors in two sum-coincidence arrangements is used, and experimental details and theoretical computations are reported. From a table showing experimental and theoretical values of the asymmetry ratio for the various azimuthal angles at each of the primary scattering angles, net discrepancies are noted and a discussion presented to explain them. It is concluded that the Klein–Bishina theory predicts the polarization effects in inelastic scattering accurately at least to the first order. R.Ll.

N67-12594# Punjab Univ., Chandigarh (India).
NON-RESONANT ELASTIC SCATTERING OF GAMMA RAYS
M. Singh, S. Anand, and B. S. Sood *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 255–259 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A method of using Z dependence results of elastic scattering with the exact calculations for mercury, to estimate the nonresonant scattering cross section for low energy gamma rays at different values of atomic number, scattering angle, and energies is described. Typical results obtained for 1.12 MeV for lead, platinum, tantalum, and tin at different scattering angles are shown graphically. For comparison, theoretical values obtained from the extrapolation of exact calculations and Z-dependence values are also plotted. Experimental results were found to agree well with estimates, especially for tin. R.Ll.

N67-12595# Bose Research Inst., Calcutta (India).
AN EMPIRICAL FORMULA FOR THE COHERENT SCATTERING CROSS SECTION OF GAMMA RAYS
A. Nath and A. M. Ghose *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 260–264 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Rayleigh scattering, the most predominant coherent scattering process for γ-rays and for momentum transfer, is considered. An empirical formula, based entirely on the experimentally observed cross sections for the estimation of the Rayleigh scattering cross section, is expressed analytically. The experimental cross section for lead, tin, and copper is compared with the respective curves from the formula. For all gamma ray energies considered, the empirical formula appears to reproduce the cross section values generally within 10–15%. R.Ll.

N67-12596# Bose Research Inst., Calcutta (India).
MEASUREMENT OF THE PHOTOELECTRIC CROSS SECTION OF LEAD FOR ^{54}Mn PHOTONS
A. Dasgupta, A. Nath, and A. M. Ghose *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 265–267 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

To implement earlier investigations on photoelectric absorption of γ-rays, photoelectric absorption cross section in lead was measured by the sphere transmission method with ^{54}Mn (0.84 MeV) photons. Experimental arrangements are detailed, and mathematical expressions reported. Self-absorption in the source and error due to the small variation of the efficiency of the counter with the change in the energy of the photons and other corrections were considered negligible. The final value of the total photoelectric cross section of lead for ^{54}Mn photons (0.84 MeV) after the corrections indicated, was measured as 8.2 ± 0.6 barns/atom. Using the intrapolated value for the K-shell photoelectric cross section of lead, the value of the total to K-shell photo absorption in lead was found and considered to be in reasonable agreement with the value observed for ^{137}Cs photons (0.66 MeV). R.Ll.

N67-12597# India. Dept. of Atomic Energy, Bombay.
MEASUREMENT OF NEUTRON SPECTRUM BY TRANSMISSION METHOD
D. N. S. Ramakrishna and M. P. Navalkar *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 268–272 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Of interest in calculating the energy distribution of neutrons in a reactor, a transmission method of measuring the neutron spectrum is reported. A collimated beam of neutrons emerging out of the reactor was passed through a 1/V absorber of different thicknesses. The ratio between the neutron densities with and without the absorber is measured as a function of its thickness, and from the transmission data obtained, the spectrum was determined. The neutron spectra derived from the experimental data are graphed, and it is seen that the spectrum agrees fairly well with the Maxwellian distribution at 327°K. Another spectrum graphed corresponds to 380°K and is seen to depart considerably from the Maxwellian form. Neutron temperature, characteristic of the distribution function, was obtained within an accuracy of about $\pm 10\%$. In view of the simplicity of the method, it is considered practicable inside the core, using a suitable Laplace transform to take into account the isotropic distribution. This avoids the difficulty of estimating neutron temperture from the emergent beams. R.Ll.

N67-12598# India. Dept. of Atomic Energy, Bombay.
STUDY OF NEUTRON RESONANCE PARAMETERS USING SLOWING DOWN TIME LEAD SPECTROMETER
K. Chandramoleswar, M. P. Navalkar, M. R. Phirke, J. V. Ramana, D. V. S. Ramakrishna et al *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 273–278 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

A preliminary determination of neutron resonance parameters of known isolated resonances due to ^{109}Ag and ^{197}Au is reported. Measurements were undertaken to establish this method of analysis with the spectrometer, and to apply it to other elements for which resonance parameters are not accurately known. The operating principle of the slowing down time lead spectrometer is mentioned, and the method of analysis specified. A comparison of values show that parameters can be determined fairly accurately by using this type of spectrometer. It is indicated that the slowing down time lead spectrometer together with the area method of analysis, which is independent of instrumental resolution, is useful for determining neutron resonance parameters over a three-decade scale of energy (1–1 KeV). R.LI.

N67-12605# India. Dept. of Atomic Energy, Bombay.
ON THE REACTIVITY WORTH OF TRANSVERSE CONTROL RODS
H. D. Purandare *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 303–306 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

Equations are presented for the reactivity worth of partially inserted control rods, and results are tabulated for a combination of six control rods of cobalt for a reactor core. The case presented is an extension of the method in which a variational technique is combined with the problem of finding the effective multiplication factor to make a rectangular parallelepiped reactor critical. In the calculations the control rods, all parallel to each other, belong to two groups: one group consists of two rods placed in the mid-plane of the core and symmetric with respect to the center. The other group consists of four rods that are symmetric with respect to the center. It is assumed that a rod consists of two equal parts, each of which goes in the core to the same extent from the outer surface of the reactor. S.P.

N67-12613# Bose Research Inst., Calcutta (India).
RESPONSE OF PLASTIC SCINTILLATORS TOWARDS FAST NEUTRONS AND ITS APPLICATIONS
Arun Chatterjee and A. M. Ghose *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 339–344 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The limitations of plastic scintillators due to their complex pulse height distribution are discussed, and it is shown that the high-energy portion of the pulse height distribution curve can be explained in terms of Birk's semi-theoretical formula. Theoretical and experimental curves are presented for a cylindrical scintillator of 1-1/2-inch diameter and 1/2-inch height, and for a spherical detector of 1/2-inch diameter. To apply the detector for quantitative estimation of neutron flux, the fraction of neutrons detected was calculated when the discriminator was set at any preassigned value. Equations are included for the pulse height spectrum and for neutron scattering. K.W.

N67-12614# Indian Inst. of Tech., Kanpur.
PICK-UP REJECTION SCHEME FOR LOW COUNTING RATE EXPERIMENTS
G. K. Mehta and E. Melkonian (Columbia Univ., N. Y.) *In* India. Dept. of Atomic Energy Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 345–347 refs (See N67-12541 03-24) CFSTI: HC $7.32/MF $2.00

The reduction or elimination of spurious pulses arising from electrical pickup or transients during low counting rate experiments was studied. Experiments indicated that the pickup occurred in short pulses coming in a train of many microseconds duration, whereas the genuine pulse rate was of the order of one per second. A circuit is described which was designed to reject pulses with repetition rates of less than 3 μs and to pass pulses coming at intervals greater by 3 μs than genuine pulses. The sensing is done by a flip-flop which gives one output for two input pulses. K.W.

N67-12624# European Organization for Nuclear Research, Geneva (Switzerland). Synchro-Cyclotron Machine Div.
STUDIES ON CAPTURE EFFICIENCIES OF SYNCHRO-CYCLOTRONS
S. Kullander 31 Aug. 1966 34 p refs
(CERN-66-27)

The starting phase of the particles in relation to the radio frequency affects the capture time considerably. This is found from numerical computations in which both the equilibrium phase and the starting phase have been varied. The total capture time per acceleration cycle has been derived from an integration over the starting phase interval 0° to 60°. The phase oscillations are damped with increasing energy; this fact has been used to minimize the acceleration time. The frequency range will be reduced considerably if radially increasing magnetic fields are employed. The capture efficiency, however, does not differ compared to that which can be obtained for actual linearly sloping fields. Intensities are estimated by means of the presented results and from available space-charge theories. A synchro-cyclotron of 600 MeV energy can be improved to deliver at least 60 μA of protons. Author

N67-12638# Junta de Energia Nuclear, Madrid (Spain).
CONTRIBUTION TO THE STUDY OF THE BEHAVIOR OF SOME NUCLEAR FISSION PRODUCTS IN THE MAKING OF CHEESE FROM SHEEP'S MILK [CONTRIBUICAO PARA O ESTUDO DO COMPORTAMENTO DE ALGUNS PRODUTOS DE CISAO NUCLEAR NO FABRICO DE QUEIJO DE LEITE DE OVELHA]
Jose Henriques Simoes and Augusto Jorge Ribeiro Da Fonseca 1966 10 p refs In PORTUGUESE
(Doc.-LFEN-60) CFSTI: HC $1.00/MF $0.50

To control radioactive contamination of food products, the production of cheese from sheep's milk is considered. In emergency situations when foodstuffs become contaminated by the cesium 137 isotope, the fixation of radioactive products in an organism can be lessened by a technique mentioned. It is stated that to combat iodine 131 and barium 140 contamination, the milk industry can resort to dehydration. The detection of strontium 90 in the making of Gouda cheese is reviewed. Experimental results show that the retention of cesium 137 in cow's milk is directly proportional to the degree of humidity. It was concluded that the cheese making process is an effective way to combat radioactive material in sheep's milk. Transl. by R.LI.

N67-12681# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
CONTRIBUTIONS TO THE WILLIAMSBURG CONFERENCE ON INTERMEDIATE ENERGY PHYSICS
R. L. Burman, K. F. Kinsey, P. F. M. Koehler, D. Koltun, F. L. Lobkowicz et al 25 Feb. 1966 76 p refs Conf. held at Williamsburg, Va., 10–12 Feb. 1966
(Contract AT(30-1)-875)
(UR-875-126) CFSTI: HC $3.00/MF $0.75

CONTENTS:

1. TWO NUCLEON EMISSION FOLLOWING ABSORPTION OF STOPPED NEGATIVE PIONS M. E. Nordberg, Jr., K. F. Kinsey, and R. L. Burman 15 p refs (See N67-12682 03-24)

2. THEORY OF PION ABSORPTION ON LIGHT NUCLEI D. Koltun and A. Reitan 12 p refs (See N67-12683 03-24)

3. A MEASUREMENT OF THE LIFETIME OF THE POSITIVE PION K. F. Kinsey, L. Lobkowicz, and M. E. Nordberg, Jr. 11 p ref (See N67-12684 03-24)

4. NUCLEON–NUCLEON BREMSSTRAHLUNG AT 200 MeV K. W. Rothe, P. F. M. Koehler, and E. H. Thorndike 18 p refs (See N67-12685 03-24)

5. NEUTRON–PROTON INTERACTIONS AT 200 MeV E. H. Thorndike, N. W. Reay, D. Spalding, and A. R. Thomas 12 p refs (See N67-12686 03-24)

N67-12682# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
TWO NUCLEON EMISSION FOLLOWING ABSORPTION OF STOPPED NEGATIVE PIONS
M. E. Nordberg, Jr., K. F. Kinsey, and R. L. Burman *In its* Contrib. to the Williamsburg Conf. on Intermediate Energy Phys. 25 Feb. 1966 16 p refs (See N67-12681 03-24) CFSTI: HC $3.00/MF $0.75

A beam of negative pions was brought to rest in a variety of light element targets ranging from Li^6 to Al^{27}. The angular distributions of neutron-proton and neutron-neutron pairs emitted in the subsequent pion capture process were measured. The protons were detected in a scintillation counter telescope and the neutrons were detected in a plastic scintillation counter with an anti-coincidence guard counter. The threshold requirements discriminated against low energy evaporation nucleons. The angular distributions peak strongly at 180°. These distributions and the comparison of n–n to p–n rates are discussed and compared with other similar measurements and theoretical analysis. Author

N67-12683# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
THEORY OF PION ABSORPTION ON LIGHT NUCLEI
D. Koltun and A. Reitan *In its* Contrib. to the Williamsburg Conf. on Intermediate Energy Phys. 25 Feb. 1966 12 p refs (See N67-12681 03-24) CFSTI: HC $3.00/MF $0.75

Consideration is given to the absorption of a pion by a nucleus with the emission of two fast nucleons in the impulse approximation such that only the two recoiling nucleons interact with the pion. The interaction of the pion or fast nucleons with other nucleons is neglected, but an attempt is made to treat the direct process in some detail. R.N.A.

N67-12684# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
A MEASUREMENT OF THE LIFETIME OF THE POSITIVE PION
K. F. Kinsey, L. Lobkowicz, and M. E. Nordberg, Jr. *In its* Contrib. to the Williamsburg Conf. on Intermediate Energy Phys. 25 Feb. 1966 11 p ref (See N67-12681 03-24) CFSTI: HC $3.00/MF $0.75

The apparatus, procedures, and results of a data analysis are described for an experiment which was conducted to measure the decay of about 10^8 positive pions. The lifetime value selected was 26.40 ±0.08. The uncertainty is larger than statistics would suggest, but within this range, the lifetime is constant over several mean lives. This value disagrees with that of two earlier experiments and although there are several differences in techniques between the experiments, there are no obvious grounds for the disagreement. R.N.A.

N67-12685# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
NUCLEON-NUCLEON BREMSSTRAHLUNG AT 200 MeV
K. W. Rothe, P. F. M. Koehler, and E. H. Thorndike *In its* Contrib. to the Williamsburg Conf. on Intermediate Energy Phys. 25 Feb. 1966 18 p refs (See N67-12681 03-24) CFSTI: HC $3.00/MF $0.75

A discussion is presented concerning a completed ppγ experiment and a pdγ experiment which is still in progress. Both experiments were run in a 130-inch cyclotron at energies near 200 MeV. The experiments were conducted to examine in detail the behavior of off mass shell nucleon–nucleon scattering. R.N.A.

N67-12686# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
NEUTRON-PROTON INTERACTIONS AT 205 MeV
E. H. Thorndike, N. W. Reay, D. Spalding, and A. R. Thomas *In its* Contrib. to the Williamsburg Conf. on Intermediate Energy Phys. 25 Feb. 1966 12 p refs (See N67-12681 03-24) CFSTI: HC $3.00/MF $0.75

The neutron-proton interaction was studied by bombarding deuterons with 205 MeV polarized protons and observing high energy neutrons recoiling into forward angles. The parameters P and R_t were measured. The incident proton beam polarization was manipulated with a solenoid so that it lay in a horizontal plane and normal to the beam direction. It sign was reversing the current direction through the solenoid. Results are presented graphically and discussed. R.N.A.

N67-12838# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE RATIO OF CAPTURE TO FISSION IN ^{235}U AND ^{239}Pu
R. W. Durham, G. C. Hanna, M. Lounsbury, C. B. Bigham, R. G. Hart Oct. 1966 17 p refs
(AECL-2618) CFSTI: HC $1.00/MF $0.50

Thin samples of uranium and plutonium in the pneumatic carrier of the NRU reactor (natural uranium fueling) were studied and their changes in isotopic composition were measured by a mass spectrometer, in order to obtain information on radiative capture in ^{235}U at thermal and epithermal neutron energies and on capture and absorption in ^{239}Pu. Two irradiations were performed. In the first irradiation a sample of natural uranium was irradiated bare and a sample enriched in ^{235}U was irradiated under cadmium. The arrangements for the second irradiation were similar except that both the bare natural uranium and cadmium-covered enriched uranium samples were accompanied by sample of PuO_2. The value of α (the ratio of capture to fission cross sections) for ^{235}U was measured as 0.1765±0.0015 for 2200 m/s neutrons and the resonance capture integral was measured as 143±7 b above 0.5 eV. For ^{239}Pu 2200 m/s values of $\alpha = 0.3597 \pm 0.0046$, $\sigma_a = 1021 \pm 12$ b, and $\sigma_f = 751 \pm 10$ b were obtained. By combining the value of σ_a from transmission measurements (1006.6–6.4 b) with the present measurement, a value of 740±6 b was obtained for the fission cross section. S.C.W.

N67-12885# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
INTRODUCTION TO CURRENT ALGEBRA AND ITS APPLICATIONS
Ph. Meyer Jul. 1966 46p refs
(TH-168) CFSTI: HC $2.00/MF $0.50

This lecture series presentation gives an introduction to some aspects of current algebra and its applications. Discussed are: (1) the isotopic spin groups and their commutation relations; (2) the $SU_3 \otimes SU_3$ symmetry group and its extensions; (3) Schwinger terms and their symmetry in the simultaneous exchange of space time and unitary space components in the quark model; (4) the Adler-Weisberger relation for calculating weak axial coupling constants in terms of extrapolated cross sections of strong interacting processes; (5) the infinite momentum limit; (6) strangeness-changing currents and the F/D ratio of leptonic hadron decay; (7) sum rules for $k^2 \neq 0$ and non-zero momentum transfer; (8) sum rules involving the commutator of two space components of currents; and other elementary particle calculations. G.G.

N67-12900# India. Dept. of Atomic Energy, Bombay.
VAN DE GRAAFF LABORATORY Progress Report, 1965
T. P. David, comp. 1966 71 p refs
(AEET-254) CFSTI: HC $3.00/MF $0.75

This report covers the operation and utilization of the 5.5 MeV Van de Graaff Accelerator in the year 1965. The communication receiver on the control console used for measuring the NMR frequency has been replaced with a precision Hewlett Packard frequency counter. This has enabled accurate determination of the beam energy. A tape punch unit has been added to the TMC 400

channel analyser. The punched tape can be fed directly into the computer, considerably reducing the time needed for analysing the data obtained from the 400 channel analyser. The research program with the accelerator has been aimed at a study of nuclear reactions and nuclear structure utilizing charged particle reactions. The nuclear reactions studied include proton and alpha induced reactions for light and medium weight nuclei involving single level resonance theory, fluctuation theory and stripping theory. Angular correlation experiments for deuteron induced such as (d, pγ) reactions, aimed at studying low lying levels of nuclei, have also been undertaken.
Author

N67-12923*# Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
ANGULAR CORRELATION OF CASCADE GAMMA RAYS IN ^{94}NB
R. A. Kuebbing and K. J. Casper [1966] 13 p refs
(Grant NsG-655)
(NASA-CR-80193) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The directional correlation and polarization correlation of the 703–871 keV gamma ray cascade following the decay of 20.00 year ^{94}Nb have been measured. On the basis of these measurements the spin and parity of the 1574 keV level in ^{94}Mo has been determined as 4+.
Author

N67-12960# National Bureau of Standards, Washington, D. C. Heat Div.
A SURVEY OF SOME EMPIRICAL AND SEMI-EMPIRICAL INTERATOMIC AND INTERMOLECULAR POTENTIALS
Benjamin M. Axilrod 3 Oct. 1966 57 p refs
(NBS-TN-246) GPO: $0.40

Many empirical and semi-empirical potential functions have been proposed or developed to represent the pairwise interaction of atoms and molecules. The simpler pair potentials proposed usually contain parameters to be adjusted to fit certain properties, for example, when chemical combination does not occur, virial coefficients and similar quantities for the gaseous state, or compressibility and heat of sublimation for the crystalline state. A number of potentials proposed recently are examined to indicate the variety of concepts employed and the suitability of the potential functions.
Author

N67-13116*# Oak Ridge National Lab., Tenn.
SOME EFFECTS OF A MODIFIED EVAPORATION PROGRAM ON CALCULATIONS OF RADIOCHEMICAL CROSS SECTIONS AND PARTICLE MULTIPLICITIES FOR PROTONS ON CARBON AND ALUMINUM TARGETS
Hugo W. Bertini 14 Nov. 1966 10 p refs
(NASA Order R-104)
(NASA-CR-80437; ORNL-TM-1549) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Earlier calculations of radiochemical cross sections by the usual cascade-evaporation approach for 25- to 400-MeV protons incident on aluminum and carbon have been repeated to determine the effects of some modifications made in the Fortran coded evaporation program. For aluminum the effect is to improve the agreement of the calculated cross section with experiment for the two reactions calculated; but for carbon the modifications resulted in no change in one case and decreased the agreement in another case. The most significant change in the particle multiplicities is that the average number of neutrons evaporated in the higher energy reactions with aluminum is about 25% higher when the modified program is used.
Author

N67-13122*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
CORRECTIONS TO THE BORN–OPPENHEIMER APPROXIMATION, PART I
Russell T. Pack 15 Nov. 1966 88 p
(Grant NsG-275-62)
(NASA-CR-80492; WIS-TCI-197, Pt. I) CFSTI: HC $2.50/MF $0.75 CSCL 20H

In this study the center of mass and rotational motions of an arbitrary diatomic system are exactly separated off. The removal is simplified by the use of the rotation operator itself rather than the representations of the rotation group. The Breit–Pauli Hamiltonian (which allows magnetic and relativistic corrections to be included) is carried through the transformations. Coupled equations for internal motion are obtained which form a basic starting point for any exact treatment of diatomic molecules. Use of angular momentum raising and lowering operators allows the coupled equations to be expressed in a simpler form than they have been previously. The equations are treated here by perturbation methods which start from the adiabatic and Born–Oppenheimer approximations. Selection rules and formulas for the corrections to long-range interatomic potentials are given, and significant corrections to the centrifugal potential are found. Finally, the interaction of two hydrogen atoms is treated as an example.
Author

N67-13123*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
CORRECTIONS TO THE BORN–OPPENHEIMER APPROXIMATION, PART II
Russell T. Pack 15 Nov. 1966 185 p refs For abstract see N67-13122
(Grant NsG-275)
(NASA-CR-80491; WIS-TCI-197, Pt. II) CFSTI: HC $3.25/MF $1.00 CSCL 20H

N67-13142# Oxford Univ. (England). Nuclear Physics Lab.
COLLECTIVE RETARDATION IN MASS 15 NUCLEI
H. J. Rose and J. S. Lopes Sacavem, Portugal. Lab. de Fis. e Eng. Nucl., 1965 11 p refs
(LFEN-41(BETA)) CFSTI: HC $1.00/MF $0.50

The 6.15 and 6.33 MeV, $J^{\pi} = 3^-/2$ mirror states in ^{15}O and ^{15}N were analyzed and evidence was found that these states are more accurately described as a p(1/2) hole in the 2^+, 6.92 MeV state of ^{16}O than as a p(3/2) hole in the ^{16}O ground state. Compared were the measured magnitudes of the E2/M1 mixing ratios of the mirror transitions 6.33 → 0 MeV, $3^-/2 \rightarrow 1^-/2$ in ^{15}N and 6.15 → 0 MeV, $3^-/2 \rightarrow 1^-/2$ in ^{15}O, and it was found that $x(^{15}O)$ seems to be larger than $x(^{15}N)$. A mathematical model was proposed that assumes that the states at 9.16 MeV in ^{15}N and 8.99 MeV in ^{15}O are the $3^-/2$ primarily single hole states in which the orthogonal wave functions yield constructive interference between the single particle and collective parts of the E2 matrix element.
G.G.

N67-13154# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
WIDE ANGLE PAIRS PRODUCED IN PI–NUCLEON INTERACTIONS
Guru Vachan Dass and Marc Ross (Rutherford High Energy Lab.) Sep. 1966 12 p refs
(AERE-R-5287) HMSO: 1s 9d

An explanation is proposed for the high mass electron–positron pairs with an invariant mass of about 400 to 600 MeV and the very low mass pairs that were observed during an experiment on the interactions of high energy pions with some nuclei. It is suggested that the mechanism responsible for the creation of pairs is associated with inverse photoproduction with intermediate vector mesons.
L.E.W.

N67-13184*# California Univ., Berkeley. Space Sciences Lab.
INVESTIGATION OF KILOVOLT ION SPUTTERING
Quarterly Progress Report, Aug.–Oct. 1966
Harold P. Smith, Jr., F. C. Hurlbut, T. H. Pigford, Jhan Khan, and N. Thomas Olson 31 Oct. 1966 20 p refs *Its* Sr. 7, Issue 71 (Contract NAS3-5743)
(NASA-CR-72012) CFSTI: HC $1.00/MF $0.50 CSCL 20H

This work constitutes an area of surface physics involving the interaction of ions and protons with material surfaces. Specifically, heavy ion (cesium and mercury) surface interactions are observed by measuring sputtering yields, angular distribution of sputtered atoms, energy distribution of ejected atoms and implanted ion distributions within the target lattice. The proton–surface interactions studies constitute an investigation of the proton induced characteristics oxygen X-rays as a possible surface analysis device for measuring oxygen contamination of material surfaces. The following is a summary of the quarter's progress in each area. Author

N67-13227*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OSCILLATOR STRENGTHS FOR RESONANCE LINES OF IONS IN THE NEON ISOELECTRIC SEQUENCE
S. O. Kastner, K. Omidvar, and J. H. Underwood Jun. 1966 18 p refs
(NASA-TM-X-55585; X-614-66-287) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Oscillator strengths are calculated for some extreme ultraviolet resonance lines of ions in the neon isoelectronic sequence, on the basis of single configurations in intermediate coupling. Making plausible assumptions concerning the conditions of excitation in the corona and in spark sources, fairly good agreement with observation was found in the case of the important coronal Fe XVII lines, but the results of the calculations disagree with the few observations of earlier ions in the sequence. If the comparison is meaningful, configuration interaction may be responsible. Author

N67-13233*# Consultants and Designers, Inc., Arlington, Va.
ON THE FLUCTUATIONS OF ENERGY FLUXES OF THE NUCLEAR-ACTIVE AND ELECTRON–PHOTON COMPONENTS OF AN EXTENSIVE AIR SHOWER [O FLUKTUATSIYAKH POTOKOV ENERGII YADERNO-AKTIVNOY I ELEKTRONNO–FOTONNOY KOMPONENT SHIROKOGO ATMOSFERNOGO LIVNYA]
S. N. Vernov, N. F. Belyayeva, O. V. Vedeneyev, V. A. Dmitriyev, Ya. A. Nechin et al 5 Feb. 1966 19 p refs Transl. into ENGLISH from Yadern. Fiz. (Moscow), v. 2, Issue 6, 1965 p 1075–1086
(Contract NAS5-3760)
(NASA-CR-80580; ST-PF-NP-10444) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Experimental data are presented on the fluctuations of energy fluxes of the nuclear-active and electron–photon components of an extensive air-shower and on the mutual relationship of these fluctuations with those of the shower's age parameter *s*. It is shown that the aggregate of experimental data is in contradiction with the model described. The great significance of the experimentally established correlations between the parameter *s* and the other characteristics for a correct experimental setup regarding the extensive air showers is discussed. Author

N67-13250# Oak Ridge National Lab., Tenn.
PHYSICS DIVISION Annual Progress Report, Year Ending 31 Dec. 1966
J. L. Fowler and H. B. Willard May 1966 179 p refs
(Contract W-7405-ENG-26)
(ORNL-3924) CFSTI: HC $5.00/MF $1.00

A report is presented on research in progress by the physics division of ORNL. Preliminary results are presented on research in high energy physics, instrumentation, nuclear reactions, neutron scattering, fission, solid state physics, superconductivity, mathematics, and biomedicine. A brief description of the 3.0-Mv, 5.5-Mv, and Tandem Van de Graaff facilities, including a cross reference to reports and papers resulting from research done on each is included. Abstracts of papers which have been published since the last annual report are also presented. NSA

N67-13268# Wisconsin Univ., Madison. Dept. of Physics.
EVIDENCE FOR A $\Sigma^-\eta$ ENHANCEMENT NEAR THRESHOLD
D. Cline and M. Olsson [1966] 17 p refs Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 1966
(Contract AT(11-1)-881)
(COO-881-75; CONF-660808-8) CFSTI: HC $1.00/MF $0.50

Evidence from a deuterium bubble chamber experiment is presented for a large cross section for the process $K^-n \rightarrow \Sigma^-\eta$ in the center of mass energy region of 1748–1900 MeV. Using the Fermi momentum of the neutron in D_2 the cross section is shown to fall with increasing center of mass energy. The threshold enhancement appears to be similar to that observed in the $K^-p \rightarrow \Lambda\eta$ and $\pi^-p \rightarrow n\eta$ systems. The angular distribution is shown to be consistent with isotropy throughout this region. Author (NSA)

N67-13269# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INVESTIGATION OF THE STRUCTURE OF ARGON K-SERIES DURING AN ATOMIC CAPTURE OF NEGATIVE MUONS IN PURE GAS AND IN A MIXTURE WITH HYDROGEN [ISSLEDOVANIE STRUKTURY K-SERII ARGONA PRI ATOMNOM ZAKHVATE OTRITSATEL'NYKH MYUONOV V CHISTOM GAZE I V SMESI S VODORODOM]
Yu. G. Budyashov, P. F. Ermolov, V. G. Zinov, A. D. Konin, and A. I. Mukhin 1966 7 p refs In RUSSIAN Submitted for Publication
(JINR-P-2807)

The experiments showed that during the argon interception of the negative muon in (p-μ) nucleus, the intensity of the hard lines in argon k-series is sharply increased in comparison to the case of direct muon capture by argon. NSA

N67-13270# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INVESTIGATION OF THE INTERACTION OF π^--MESONS WITH XENON NUCLEI AT 5 AND 9 GeV/c BY STUDYING THE DISTRIBUTIONS OF THE PRODUCED π^0MESONS [ISSLEDOVANIE PROTSESSA VZAIMODEISTVIYA π^--MEZONOV S YADRAMI KSENONA PRI 5 I 9 GeV/c POSREDSTVOM IZUCHENIYA KHARAKTERISTIK OBRAZOVANNYKH V NEM π^0-MEZONOV]
N. Dashkevich, B. Slovinskii, and Z. S. Strugal'skii 1966 16 p refs In RUSSIAN Submitted for Publication
(JINR-P-2736)

Energy, angular, and multiplicity distributions of γ quants produced by 5 and 9 BeV/c meson (π^-) interactions with xenon nuclei are investigated. The analysis shows that the quasi-elementary interactions play a predominant role in the considered π^--Xe interactions with a small (≤ 4) number of charged secondary particles. Author (NSA)

N67-13271# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INELASTIC INTERACTIONS OF 19.8-GeV/c PROTONS WITH NEUTRONS [NEUPRUGIE VZAIMODEISTVIYA PROTONOV S IMPUL'SOM 19.8 GeV/c S NEITRONAMI]
N. P. Bogachev and Yu. P. Merekov 1966 4 p In RUSSIAN
(JINR-P-2809)

The nuclear emulsion method was used to determine energy and angular distributions of secondary particles (protons and charged π-mesons) produced by inelastic p–n interactions. The upper boundary of the coherent production of π mesons by 19.8-Bev/c protons in complex nuclear emulsions was evaluated.
Author (NSA)

N67-13274# Institut National des Sciences et Techniques Nucleaires, Saclay (France).
AN INTRODUCTION TO THE STUDY OF LINEAR ACCELERATOR [INTRODUCTION A L'ETUDE DES ACCELERATEURS LINEAIRES]
P. Lapostolle Geneva, CERN, 7 Jun. 1966 75 p In FRENCH; ENGLISH summary
(CERN-66-20)

An introduction to the study of linear accelerators is presented, rather than an extensive report making a completely up-to-date review of all linear accelerator problems. It endeavors to collect together the basis of theory and the relevant technical ideas, which are usually dispersed among many reports, though it has no pretensions to being complete. Emphasis is placed on proton linacs, though electrons and heavy ions are also included. The presentation is dictated by pedagogical concern, but a table of contents will guide the reader in finding the appropriate chapters. Author (NSA)

N67-13276# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
IDENTIFICATION OF CHARGED PARTICLES BY IONIZATION AND δ-ELECTRONS IN A PROPANE BUBBLE CHAMBER [IDENTIFIKATSIYA ZARYAZHENNYKH CHASTITS PO IONIZATSII I δ-ELEKTRONAM V PROPANOVOI PUZYR'KOVOI KAMERE]
Ya. Bem, V. G. Grishin, A. G. Kriventsova, M. M. Muminov, and Z. Trka 1 Apr. 1966 13 p refs In RUSSIAN
(JINR-P-2842)

The results of ionization measurements of positive particles in a 24-liter propane chamber are given. It is found that for the particles with pc≤1 Bev, by this method it is possible to distinguish between protons and π^+ mesons. A computer program is worked out and the method of the identification of the particles with pc≥1 Bev by δ electrons is tested. The ranges of electrons and positrons with E≤8 Mev in propane are calculated. Author (NSA)

N67-13278# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
USE OF MICA AND QUARTZ GLASS FOR NUCLEAR FISSION DETECTION AT HIGH TEMPERATURE [PRIMENENIE SLYUDY I KARTSEVOGO STEKLA DLYA REGISTRATSII DELENIYA YADER PRI POVYSHENNYKH TEMPERATURAKH]
A. Kapustsik, V. P. Perelygin, V. I. Sviderskii, and S. P. Tret'yakova 1966 8p refs In RUSSIAN
(JINR-P-2705)

The use of mica and quartz glass is described for the detection of rare acts of nuclear fission at 350–400°C. The efficiencies of detection of fission fragments are measured depending on the air layer thickness between the sample and the detectors.
Author (NSA)

N67-13279# Wisconsin Univ., Madison. Dept. of Physics.
STUDY OF THE POLARIZATION OF THE NEUTRON FROM $\Sigma^+ \rightarrow \pi^+ + n$
D. Cline and J. Robinson [1966] 11 p refs Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 1966
(Contract AT(11-1)-881)
(COO-881-76; CONF-660808-6) CFSTI: HC $1.00/MF $0.50

The orbital angular momentum of polarized Σ^+ decay is determined by measuring the polarization of the neutron using n–p scattering as an analyzer in a hydrogen bubble chamber. On the basis of 65 events preliminary results of the experiment favor a $P_{1/2}$ state for the $\pi^+ n$ system. Author (NSA)

N67-13281# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MEASUREMENT OF THE CASCADE TIME OF NEGATIVE PIONS IN GASEOUS He^3 [IZMERENIE VREMENI KASKADNOGO PEREKHODA π^--MEZONA V GAZOOBRAZNOM GELII-3]
O. A. Zaimidoroga, R. M. Sulyaev, and V. M. Tsuko-Sitnikov 1966 7 p refs In RUSSIAN
(JINR-P-2838)

The cascade time of negative pions in gaseous helium-3 was measured by using a diffusion chamber in a magnetic field. It was found to be $(1.4+0.7)\ 10^{-10}$ sec. The measured time coincides with that of analogous measurement in liquid helium. This means that the cascade time of pions in helium does not depend on the medium density. Author (NSA)

N67-13282# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
MEASUREMENT OF ELECTRONS MOMENTUM BY SPARK CHAMBERS IN MAGNETIC FIELD [MISURA DELLA QUANTITA DI MOTO DI ELETTRONI, CON CAMERE A SCINTILLA POSTE IN CAMPO MAGNETICO]
G. Farchi 27 Apr. 1966 23 p refs In ITALIAN
(ISS-66/18)

The calculation of the precision that is possible to attain in the measurement of the momentum of electrons deflected by a magnetic field and detected in the field by 3 or 4 one-gap spark chambers. The momentum error is calculated starting from the measurement errors in each chamber. Author (NSA)

N67-13283# Brookhaven National Lab., Upton, N. Y.
MEASUREMENTS OF THE MULTISTEM DRIFT TUBE STRUCTURE FOR PROTON ACCELERATORS
S. Giordano 22 Jun. 1966 17 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10376) CFSTI: HC $1.00/MF $0.50

The operating characteristics of a multistem drift tube structure for accelerating protons below an energy of 200 Mev are described.
NSA

N67-13284# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
OBSERVATION OF THE $\Lambda\eta^0$ RESONANCE IN $\pi^- p$ INTERACTIONS AT 4.0 GeV/c
B. P. Bannik, E. G. Bubelev, B. Chadraa, I. V. Chuvilo, Kim Hi In et al 1966 16 p refs
(JINR-E-2858)

The radiative decays of resonances with Λ hyperons involved were studied in the JINR 24-liter propane bubble chamber exposed to 4.0 Bev/c negative pions. The $M_{\Lambda\gamma}$ effective mass distribution exhibits a peak which can be explained by the existence of the $\Lambda\eta^0$ resonance with mass of about 1680 Mev. The kinematic influence of the known hyperon resonances on the distribution is discussed. An attempt is being made to determine the $\Lambda\eta^0$ spin.
Author (NSA)

N67-13285# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE RATIO OF THE AXIAL AND VECTOR CONSTANTS IN DYNAMICAL QUARK MODEL
P. N. Bogolyubov 1966 4 p refs
(JINR-E-2827)

The quark magnetic moment in the potential well is calculated. On the basis of the experimental value of the proton magnetic moment, (g_A/g_V) is obtained to be 1.185.

Author (NSA)

N67-13287# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

ON POSSIBILITY OF AN EXPERIMENTAL TEST OF CP-INVARIANCE IN $K_S^0 \rightarrow 3\pi$ DECAYS IN CORRELATION EXPERIMENTS WITH $K^0 \bar{K}^0$ PAIRS [EKSPERIMENTAL'NYE VOZMOZHNOSTI PROVERKI CP-INVARIANTNOSTI RASPADAKH $K_S^0 \rightarrow 3\pi$ V KORRELYATSIONNYKH OPYTAKH S PARAMI $K^0\bar{K}^0$]

Yu. Lukstyn'sh and E. Okonov 1966 7 p refs In RUSSIAN; ENGLISH summary
(JINR-P-2850)

The correlation experiments with $K^0\bar{K}^0$ pairs are considered, which allow to observe and investigate in pure state $K_S^0 \rightarrow 3\pi$ decays forbidden by CP invariance. One can choose such conditions of the experiment, when the interference in $K_S^0 \rightarrow 3\pi$ and $K_L^0 \rightarrow 3\pi$ decays is strongly pronounced. The possibility of an experimental investigation of $K_S^0 \rightarrow K_L^0$ regeneration is marked. Author (NSA)

N67-13291# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Soyuznyi Nauchno-Issledovatel'skii Inst. Priborostroeniya.

DETERMINATION OF THE YIELD OF D(d,n)^{3}He AND T(d,n)^{4}He REACTIONS IN THICK TARGETS AT ENERGIES UP TO 100 keV [OPREDELENIE VYKHODA REAKTSII D(d,n)^{3}He I T(d,n)^{4}He V TOLSTYKH MISHENYAKH PRI ENERGIYAKH DO 100 keV]

R. D. Vasil'ev 1966 7 p refs In RUSSIAN; ENGLISH summary
(NP-16203)

There are no known data on measurements of the D(d,n)^{3}He reaction yields from thick TiD and ZrD targets at low neutron energies. Consequently, yield determinations were carried out for D(d,n)^{3}He and T(d,n)^{4}He reactions on thick, industrially produced targets for deuterons up to 100 kev. The measured values for reaction yields were subsequently used for the calculation of neutron flux densities at distances from the target at which the authors calibrated various detection equipment. It was assumed during the yield determination that (1) the deuterium flow is constant over the depth of the target; (2) that the concentration of absorbed deuterium and tritium is uniform over the target; and (3) that one can neglect absorption and scattering within the target of charged particles leaving in the detector direction. The results are given in the form of graphs representing (a) the momentum spectrum of the charged nuclear reaction products, (b) the excitation function of the D(d,n)^{3}He and T(d,n)^{4}He reactions, and (c) the efficiency of the long neutron counter as a function of neutron energy.

NSA

N67-13296# Duke Univ., Durham, N. C.

EVIDENCE CONCERNING C VIOLATION IN ETA DECAY

L. R. Fortney, J. W. Chapman, S. Dagan, and E. C. Fowler Jul. 1966 14 p refs Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 31 Aug.–7 Sep. 1966
(Contract AT(40-1)-3065)
(ORO-3065-10; CONF-660808-5) CFSTI: HC $1.00/MF $0.50

An experiment is described in which the symmetry between π^+ and π^- in the decay $\eta \rightarrow \pi^+\pi^-\pi^0$ was studied. NSA

N67-13298# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

MEASUREMENTS OF HALF-LIFE RATIO OF π^+ AND π^- MESONS [IZMERENIE OTNOSHENIYA VREMEN ZHIZNI π^+Iπ^--MEZONOV]

V. I. Komarov, V. I. Petrukhin, and O. V. Savchenko 1966 12 p refs In RUSSIAN
(JINR-P-2802)

The lifetime ratio of π^+ and π^- mesons was measured in order to determine CPT invariance of the weak interaction responsible for pion decay. An isotropic discharge helium or neon chamber was used for recording 15 MeV pion decay. The results of the first series of photographs showed the magnitude $[\tau(\pi^+)/\tau(\pi^-)] = 0.98 \pm 0.06$. Author (NSA)

N67-13299# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

THE MOMENTUM SPECTRA OF SECONDARY PARTICLES IN (π^-,N) INTERACTIONS AT 7 GeV

F. Legar, V. Petrzhilka, and M. Suk 1966 14 p refs
(JINR-E-2738)

The experimental momentum spectra of secondary π^- mesons and protons from the (π^-,N)-interactions at 7 BeV in the laboratory system are compared with the semi-empirical formula given by Aly, Kaplan and Shen. The parameters of this formula are found by the least squares method. It is shown also that this formula gives a satisfactory description of the experiment. The best description of the spectrum of the transverse momentum components is obtained by the linear exponential distribution when an average value of the transverse momentum component $\langle p_t \rangle$ is (0.299±0.010) BeV/c. Author (NSA)

N67-13300# Georgia Inst. of Tech., Atlanta. School of Chemistry.

NEUTRON REACTION CROSS SECTIONS OF Se AND Fe AT 14.4 MeV

P. Venugopala and R. W. Fink 22 Jul. 1966 7 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract AT(40-1)-3348)
(ORO-3348-2; CONF-660906-2) CFSTI: HC $1.00/MF $0.50

An improved technique for the measurement of activation cross sections was developed which takes advantage of high resolution of Ge(Li) detectors. Neutron-induced activities in samples of natural Se and Fe were studied by this method. The following reactions of isotopes of these natural elements resulting in gamma-emitting activities were determined simultaneously: (n,2n) cross sections on ^{74}Se, ^{76}Se, ^{80}Se, ^{82}Se, and ^{54}Fe; (n,p) cross sections on ^{74}Se, ^{76}Se, ^{78}Se, and ^{54}Fe; and (n,α) cross sections on ^{78}Se, ^{80}Se, and ^{54}Fe. The method was used successfully with chemical compounds and with mixtures of powders in which one of the constituents was employed as a monitoring activity. A careful determination of these cross sections in the region Z = 30 to Z = 35 at 14.4±0.3 Mev was undertaken in view of their importance in studying shell structure effects on (n,α) and (n,2n) cross section systematics.

Author (NSA)

N67-13303# Wisconsin Univ., Madison. Dept. of Physics.

REGGE RECURRENCE PARITY ASSIGNMENTS FOR THE S = 0 REGGE RECURRENCES

V. Barger and D. Cline [1966] 21 p refs Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 1966
(Contract AT(11-1)-881)
(COO-881-77; CONF-660808-7) CFSTI: HC 1.00/MF $0.50

The S = 0 fermion resonances are classified as Regge recurrences on three straight line trajectories (namely, Δ_δ, N_α, N_γ) in A Chew–Frautschi plot. These Regge recurrence parity assignments are shown to be consistent with the structure observed in backward pion-nucleon scattering. Author (NSA)

N67-13304# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

PLANNING OF n-p SCATTERING EXPERIMENTS ABOVE THE PION-PRODUCTION THRESHOLD

Z. Yanout, V. V. Fedorov, (Moscow State Univ.), and F. Lehar 1966 26 p refs Submitted for Publication
(JINR-E-2765)

Planning of the optimal experiment was performed for the measurements of D, R, A, C_{nn}, A_{ss} in n–p-scattering at 400 and 630 MeV. From the obtained results follows that the measurement of the parameter D is most effective for discrimination of the two phase-shifts sets at both energies. The measurements must be made on the angles 60 and 115° cms at 400 and 630 MeV, respectively. Author (NSA)

N67-13308# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PHASE-SHIFT ANALYSIS OF THE NUCLEON–NUCLEON SCATTERING AT 14.5 MEV [FAZOVYI ANALIZ NUKLON-NUKLONNOGO RASSEYANIYA PRI ENERGII 14.5 MEV]
Yu. M. Kazarinov, F. Legar, and Z. Yanout 1966 12 p refs In RUSSIAN
(JINR-P-2742)
The phase-shift analysis of the experimental data obtained at an energy near 14.5 Mev is performed. Three phase-shift sets with a positive phase-shift $^1S_0$ wave are obtained which give a satisfactory description of available experimental data. The results of the analysis show that the polarized beam and polarized target experiments are the most effective way to determine precisely the deviation from the pure S-state scattering. Author (NSA)

N67-13306# Bologna Univ. (Italy). Inst. of Physics.
PION–PROTON ELASTIC SCATTERING
M. N. Focacci and G. Giacomelli Geneva, CERN, 25 Apr. 1966 129 p refs Sponsored by CERN
(CERN-66-18)

A review is presented on the present phenomenological situation of pion–proton elastic scattering, with an emphasis on high-energy data. Topics discussed are notation and general formulas, crossing symmetry, partial wave expansion, optical theorem, impact parameter expansion, connection between partial wave and impact parameter expansions, isospin analysis of the pion–nucleon system, phase-shift analysis, exchange amplitude, S-matrix, dispersion relations for the real part of the forward scattering amplitude, interference between Coulomb and nuclear scattering, Pomeranchuck theorems, implications of SU(6) symmetry for the total cross sections, optical models, Born approximation, statistical, model for larg-angle scattering, Regge poles, elastic scattering as the shadow of inelastic processes, and analysis of experimental data. NSA

N67-13310# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
THE SEARCH FOR "LONG-LIVED" Λ^0 PARTICLES [POISKI "DOLGOZHIVUSHCHIKH" Λ^0-GIPERONOV]
M. Anikina, G. Vardenga, M. Zhuravleva, D. Kotlyarevskii, Yu. Lukstyn'sh et al 1966 6 p refs In RUSSIAN Submitted for Publication
(JINR-P-2849)

The search for long-lived Λ^0 particles was made under conditions similar to those of experiments in which $K_L^0 \rightarrow \pi^+\pi^-$ decay had been observed. The distance from the target to the cloud chamber was 200 mean decay lengths. The number of decays of long-lived Λ^0-hyperon (N_Λ) in our conditions was estimated to be $N_\Lambda = 10$ if one supposes the character of nonexponentiality in K_S^0 and Λ^0 decays to be similar. The result of this experiment is: $N_\Lambda \leq 1$. The comparison of these two values demonstrates as being very unlikely the models which assume the $K^0 \rightarrow \pi^+\pi^-$ to be due to the nonexponentiality in unstable particles decays. Author (NSA)

N67-13311# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
S-MATRIX, NON-COMPACT SYMMETRY GROUPS AND THEIR COLLINEAR SUBGROUPS
Nguyen Van Hieu 1966 6 p refs
(JINR-E-2754)

The structure of the S-matrix in the symmetry with noncompact groups as well as the connection with the $SU(6)_w$ symmetry are investigated. Author (NSA)

N67-13314# California Inst. of Tech., Pasadena.
SOME TOPICS OF RECENT INTEREST IN π AND η PHOTOPRODUCTION
Clemens A. Huesch [1966] 28 p refs
(Contract AT(11-1)-68)
(CALT-68-92) CFSTI: HC $2.00/MF $0.50

Some reasons for renewed theoretical interest in photoproduction processes in the lower energy region are considered. A review is presented on recent experiments on the photoproduction of neutral pseudoscalar mesons. NSA

N67-13318# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
TIME CORRELATION OF THE EMISSION AND ABSORPTION OF THE EXCHANGE PHOTON [KORRELYATSIYA VREMEN ISPUSKANIYAI POGLOSHCHENIYA OBMENNOGO FOTONA]
B. A. Zon and M. I. Shirokov 1966 15 p refs In RUSSIAN Submitted for Publication
(JINR-P-2791)

Time correlation for the quantum electrodynamics effect is calculated, using a somewhat generalized version of the Goldberger and Watson apparatus. There are two atoms, separated by a large distance R. Initially only atom A is excited. A calculation was made for the probability of excitation of the second atom B at a moment t, provided the moment of photon emission by atom A is known. Such an effect can be considered as quantal experiment for measuring the photon velocity. The obtained results in a qualitative respect could be anticipated. But in specific conditions (very soft photon) the calculation gives appreciable probability that the photon velocity exceeds C. Author (NSA)

N67-13327# Georgia Inst. of Tech., Atlanta. School of Chemistry.
MEASUREMENT OF (n,2n), (n,p), AND (n,α) CROSS SECTIONS OF Ge AT 14.4 MeV
R. E. Wood, W. S. Cook, J. R. Goodgame, and R. W. Fink 22 Jul. 1966 7 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract AT(40-1)-3346)
(ORO-3346-3; CONF-660908-3) CFSTI: HC $1.00/MF $0.50

The nuclides ^{75}Ge, ^{69}Ge, ^{72}Ga, ^{73}Ga, ^{74}Ga, ^{69m}Zn, and ^{71m}Zn were produced by irradiating natural germanium with 14.4±0.3-MeV neutrons. A mixture of iron, aluminum, and germanium powders also was irradiated. The activities were identified from the gamma spectra taken with a Ge(Li) detector, and the cross sections were measured using the improved technique described by Rao and Fink (this conference). The reactions for which cross sections have been measured are as follows: ^{70,76}Ge(n,2n); ^{72,73,74}Ge(n,p); and ^{72,74}Ge (n,α). The results are compared with previously published work on the systematics of (n,2n), n,p), and n,α) cross sections at 14 to 15 MeV. Author (NSA)

N67-13331# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
A 220 BeV ACCELERATOR EMPLOYING A SEPARATED FUNCTION MAGNET LATTICE

G. T. Danby, J. E. Allinger, and J. W. Jackson 5 Aug. 1966 74 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10508) CFSTI: HC $3.00/MF $0.75

It is shown that a separated function 200-Bev proton synchrotron is inherently a better and more flexible machine than the conventional combined function design. Additional advantages are discussed. A cost estimate is also presented. Author (NSA)

N67-13333# Maryland Univ., College Park. Dept. of Physics and Astronomy.
BARYON–BARYON REACTIONS AND SU3 SYMMETRY
Patrick D. De Souza (Ph.D. Thesis) May 1966 88 p refs
(Contract AT(40-1)-2504)
(TR-565; ORO-2504-91) CFSTI: HC $3.00/MF $0.75

SU(3) symmetry was used in order to obtain relations between the cross sections for baryon–baryon reactions in the $_1S^0$ and $_3S^1$ states. The modifications of these relations for higher angular momentum states are derived and it is shown that the possible existence of strong coupling of the $_3D^1$ state to the $_3S^1$ state does not invalidate the above derived relations. In order to investigate the effect of mass splitting on these results a potential model calculation is carried out in order to verify the predicted equality of $_1S^0$ n-p and Σ^+–p cross sections. The calculation indicates that this relationship is indeed satisfied and that further the Σ^-–n system has a possible bound singlet state with a binding energy $\leq$-1 MeV. The multichannel Σ^-–p reactions are investigated with an SU(3) invariant K matrix using the Λ–p parameters of Burnstein and Alexander. A calculation of Σ^-–p cross sections is carried out for center of mass energies <10 MeV. The results of this calculation are not in agreement with experiment. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N67-12488# Institute of Modern Languages, Inc., Washington, D. C.
LAMINAR MAGNETO-GASODYNAMIC BOUNDARY LAYER ON A CONDUCTING SURFACE IN CROSSED ELECTRIC AND MAGNETIC FIELD [LAMINAZNYI MAGNITO–GASODINAMICHESKY POGRANICHNYI SLOYI NA PROVODIASCEYI POVEZKHNOSTI V SKRESCHENNYKH ELECTRO I MAGNIT POLIACH]
A. L. Genkin Ft. Belvoir, Va., Army Eng. and Develop. Labs., Aug. 1966 16 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (USSR), no. 3, 1965 p 401–408
(Contract DA-44-009-AMC-1563(T))
(T-1869-66; ERDL-T-1869-66; AD-639867) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: Laminar magnetogasodynamic boundary layer on a conducting surface in crossed electric and magnetic field. Author (TAB)

N67-12796*# National Aeronautics and Space Administration. Langley Research Center, Cleveland, Ohio.
REMARKS ON PRACTICAL SPECTROSCOPIC TEMPERATURE MEASUREMENTS IN PLASMAS
G. K. Oertel Washington, NASA, Dec. 1966 16 p refs
(NASA-TN-D-3737) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Spectroscopic techniques for the determination of plasma parameters are being applied to many laboratory plasmas. An attempt is made to show that the lack of spatial resolution can lead to drastic errors in spectroscopically determined temperatures even in uniform plasmas with thin boundary layers. Although the need for such resolution is emphasized, certain semiquantitative conclusions can be drawn from spatially unresolved spectra. Author

N67-12800*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF ION AND ELECTRON DENSITIES OF ELECTRON-BOMBARDMENT ION–THRUSTOR BEAM
Dale W. Cooper and Perry W. Kuhns Washington, NASA, Dec. 1966 18 p refs
(NASA-TN-D-3761) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Measurements in both the transverse and the longitudinal directions were taken of an ion–thrustor beam with Langmuir and current probes. These measurements resulted in transverse and longitudinal profiles of electron and ion densities. A comparison was made at the beam centerline between Langmuir probe, current-probe, and microwave-interferometer measurements. The measurements agreed to within ±10 percent. Author

N67-12820# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
THE EFFECT OF ION COLLISIONS AND OTHER TERMS ON THE RESISTIVE-G INSTABILITY IN PLASMAS
T. E. Stringer Jul. 1966 23 p refs Submitted for Publication
(CLM-P-110) CFSTI: HC $1.00/MF $0.50

The treatment is based on guiding center equations, which include collisional diffusion across the field lines. The eigenvalues of the resulting differential equation are found using phase-integral methods. Simple expressions are obtained for the conditions under which the resistive-g mode is stabilized. These show satisfactory agreement with a recent numerical solution of the same problem. Author

N67-12846# Indian Inst. of Science, Bangalore. Dept. of Applied Mathematics.
TRANSPORT PROCESSES IN A MULTICOMPONENT ASSEMBLY. II: FOKKER–PLANCK FORMALISM
C. Devanathan, M. R. Raghavachar, and Ram Babu *In its* J. of the Indian Inst. of Sci., Vol. 48, No. 2 and 3 Jul. 1966 p 81–97 refs (See N67-12843 03-34) CFSTI: HC $3.00/MF $0.75

It has been pointed out that when the charged particles of multicomponent assembly interact according to comparatively long range Coulomb forces, small random deflections of the particles are very effective in the evolution of the distribution function. Such small random deviations are incorporated into the kinetic equation by using Fokker–Planck formalism. The distribution functions are expanded in terms of the generalized Hermite polynomials and following Grad, consistent set of transport equations deduced. It is found that the Fokker–Planck term enhances the relaxation times of all the physical variables and thereby decreases the electrical conductivity. Apart from the anisotropy due to the magnetic field among the stresses, F–P terms introduce an additional bulk viscosity term. Further they introduce intense anisotropy among heat-flux tensors. Modified expressions for viscosity, heat conductivity, and the electrical conductivity have been deduced. Author

N67-12857# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
EXPERIMENTAL STUDIES OF PLASMA SHEATH SURROUNDING MODELS IN HOT-SHOT WIND-TUNNELS
Jacques Dorey and Didier Compard 1966 11 p refs Presented at the 2d Intern. Congr. on the Instrumentation of the Installation of Aerospacial Simulation, Stanford, Calif., 29–31 Aug. 1966; Sponsored by IEEE
(TP-376(1966)) CFSTI: HC $1.00/MF $0.50

Hotshot tunnel experiments were conducted to test plasma diagnostic methods, and to check theoretical data particularly concerning electron densities and temperatures in a chemically reactive hypersonic flow. The nitrogen flow characteristics around models were studied to determine the physical state of the plasma. Experimental apparatus and the results are described. Findings indicate that ionization is not homogeneous during the shot, which seems to confirm the assumption that the plasma flow is usable only after a delay of several 10 milliseconds following the shock formation period. M.G.J.

N67-12865# Los Alamos Scientific Lab., N. Mex.
PROPOSED STRAIGHT θ-PINCH DEVICES ENERGIZED BY THE ENERGY STORAGE SUPPLY OF THE TOROIDAL θ-PINCH (SCYLLAC)
R. S. Dike, E. L. Kemp, and W. E. Quinn 27 Jul. 1966 29 p refs
(Contract W-7405-ENG-36)
(LA-3553-MS) CFSTI: HC $2.00/MF $0.50

The design of the toroidal Scyllac device is extended to include the capability for also energizing straight θ-pinch systems with lengths of up to 22 meters. The linear devices are to be energized by the energy storage supply of and in the same building as the toroidal device. A design is presented for both a straight (parallel) device, in which the energy supply is connected in parallel to drive a single-turn compression coil, and a straight (series) apparatus in which each half of the energy supply is connected in series with the compression coil. Author (NSA)

N67-12881# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
ELECTRONIC EXCITATION TEMPERATURE MEASUREMENTS OF ARGON PLASMA JET
Goro Kammoto, Yasuo Watanabe, and Hiroyuki Shirai Dec. 1965 29 p refs
(CP-9) CFSTI: HC $2.00/MF $0.50

Spectroscopic measurements of the electronic excitation temperature have been performed in the arc-heated argon plasma-jet. Measured free stream temperatures at the exit of a supersonic "convergent–divergent" nozzle ranged from 3,700°K to 4,000°K, and no remarkable change could be observed for a threefold increase in power input to the electrodes at the gas flow rates used in the experiments. Stagnation temperatures were also measured and found to range from 4,000°K to 4,500°K. Comments on the outstanding features of the results are given. Author

N67-12924*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
CONTINUUM ELECTROMECHANICS GROUP: TRAVELING WAVE BULK ELECTROCONVECTION INDUCED ACROSS A TEMPERATURE GRADIENT
J. R. Melcher and M. S. Firebaugh 28 Oct. 1966 33 p refs
(Grant NsG-368)
(NASA-CR-80101; CSR-TR-66-13) CFSTI: HC $2.00/MF $0.50 CSCL 20I

If a temperature gradient is imposed on a slightly conducting liquid, a gradient in natural electrical conductivity generally results. It is shown that if the liquid is then subjected to a wave of electric field traveling perpendicular to the temperature and conductivity gradients, charges are induced in the liquid bulk. These charges relax to form a traveling wave which interacts with the imposed field to pump the liquid. The sign of the conductivity gradient determines whether the liquid is pumped in the same direction or a direction opposite to that of the traveling wave. Equations are given for the velocity profile in plane flow, showing the effect of fluid properties as well as of the frequency, wavelength, and potential of the traveling wave. Experiments support the significance of the theory. Observations of a type of bulk Rayleigh–Taylor instability are discussed. Author

N67-12995*# California Univ., Los Angeles. Plasma Physics Group.
EXCITATION AND DAMPING OF DRIFT WAVES
A. Y. Wong and R. Rowberg Nov. 1966 10 p refs
(Grant NGR-05-007-066)
(NASA-CR-80375; P-8) CFSTI: HC $1.00/MF $0.50 CSCL 20I

An experiment focusing on the excitation and damping of drift waves associated with the density and temperature gradients in the stable regime of a highly ionized plasma is reported. The drift wave was excited by inserting a floating tungsten grid into the plasma near the maximum density gradient. Phase measurements showed that the wave travels azimuthally in the direction of the electron diamagnetic drift and exhibits an m = 1 characteristic. The wave also reversed its direction upon reversal of the magnetic field. The optimum frequency of excitation corresponded to the naturally excited frequency in the unstable regime as density or end-plate sheath conditions were changed. Fluid equations were used for both ions and electrons and an expression for the destabilizing term was derived. In the stable regime, this destabilizing term was smaller than the damping term. It was observed that: (1) The overall damping first decreased as the axial magnetic field was lowered then increased again when the axial magnetic field was lowered beyond 1400 to 1700 gauss; (2) The damping decreases with increasing density and decreasing end-plate power which controls the plasma temperature; and (3) The damping rate varies with the excitation amplitude when $e\phi/KT \geq 20\%$. S.C.W.

N67-13042# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.
STATISTICAL MECHANICS OF NEUTRAL AND IONIZED GASES, PART I [MECCANICA STATISTICA DEI GAS NEUTRI ED IONIZZATI, PARTE I]
F. Engelmann Feb. 1966 52p refs In ITALIAN
(LGI-GG-2) CFSTI: HC $2.50/MF $0.50

The basic principles of statistical mechanics of irreversible processes are described. The review is extended to the statistics of 2-space (Boltzmann's kinetic theory of gases and Gibbs' and Tolman's theory of domains). The theory is then applied to the equations of motion (Liouville equation) and to systems containing different types of particles as an extension of BBGKY (Bogoliubov, Born, Green, Kirkwood, Yvon) equations and to the study of plasma. Klimontovich's method is also described. ESRO

N67-13043# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
OBSERVATIONS ON STABLE AND UNSTABLE BEHAVIOUR OF PREHEATED PLASMA IN LINEAR AND CUSP θ-PINCHES
H. J. Belitz, P. Bogen, K. H. Dippel, H. L. Jordan, E. Kugler et al [1966] 16 p refs Presented at 2d Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Culham, England, 6–10 Sep. 1965
CFSTI: HC $1.00/MF $0.50

Observations on plasma structure, density profiles, electron and ion Doppler temperatures and their spatial distribution and temporal development have been made using time-resolved photographic, interferometric, and spectroscopic methods in the visible and the soft X-ray regions. By variation of initial pressure, magnetic bias field, peak field, preionization, preheating, impurity concentration, and by disturbing the symmetry of the discharge tube, information on stable and unstable plasmas could be obtained. All phenomena seem to be qualitatively consistent with an explanation by Rayleigh–Taylor instabilities due to acceleration. Author (ESRO)

N67-13044# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
INVESTIGATIONS ON ELECTRODELESS ACCELERATION OF A PLASMA FOR DEVELOPMENT OF DEVICES FOR PROPULSION FOR SPACESHIPS [UNTERSUCHUNGEN ZUR ELEKTRODENLOSEN BESCHLEUNIGUNG VON PLASMA FUER DIE ENTWICKLUNG EINES RAUMANTRIEBS]
H. Tuczek Mar. 1966 75 p refs In GERMAN
(JUL-358-PP) CFSTI: HC$2.00/MF$0.50

The inductive plasma acceleration is investigated in a conical ring discharge, in a pulsed and in a periodical transient wave for development of an electrodeless plasma propulsion. The results of the conical ring discharge and the pulsed transient wave show that plasma is effectively accelerated at densities smaller than 10^{15} cm^{-3}. The acceleration process can be described in quantitative correlation with the experimental results by means of a single-particle model with elastic ion reflection at a rigid piston. According to the measurements on the periodical transient wave it is possible to produce and accelerate the plasma without additional preheating and therefore plasma propulsion with thrusts up to 1 kp appears technically feasible. ESRO

N67-13045# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.
HIGH VELOCITY IMPACT OF DENSE MEDIA
J. P. Somon Jul. 1966 34 p refs
(LGI-66-9) CFSTI: HC$2.00/MF$0.50

The study, in plane geometry, of the compression of a solid or gaseous medium G is the object of this report. Shock waves are created and reflected between the walls π and Σ in the medium G. Formulas relative to different situations of collisions between several media have been established. They have been applied to the case of dense media, such as metals or solid deuterium, but depend only on the density ratio of the media, provided the shocks are strong and the media behave as perfect gases behind the shocks. ESRO

N67-13046# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
PLASMA ACCELERATION BY MAGNETIC PISTON AFTER A FREE PARTICLE MODEL [BESCHLEUNIGUNG EINES PLASMAS DURCH EINEN MAGNETISCHEN KOLBEN NACH DEM "FREE PARTICLE" MODELL]
W. Bieger, P. Graeff (Max-Planck-Inst. fuer Physik und Astrophysik), and H. Tuczek Nov. 1965 18 p refs In GERMAN
(JUL-336-PP) CFSTI: HC$1.00/MF$0.50

Plasma acceleration by means of a magnetic piston is described by a one-dimensional free particle model. The thermal plasma energy is assumed small against the collective energy of motion so that the initial state is adequately described by specification of the line density $\rho_0(x)$ and the energy $E_0(x)$ of motion. ESRO

N67-13047# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
EXPERIMENTS ON PRODUCTION OF A CUSP-SHAPED PLASMA BY FAST MAGNETIC COMPRESSION [EXPERIMENTE ZUR ERZEUGUNG EINES CUSPFOERMIGEN PLASMAS DURCH SCHNELLE MAGNETISCHE KOMPRESSION]
H.-J. Belitz and E. Kugler Dec. 1965 45 p refs In GERMAN
(JUL-339-PP) CFSTI: HC$2.00/MF$0.50

A 10 kJ cusp compression experiment is described, the set-up of which conforms to that of two 5 kJ Theta Pinch experiments. The measurements made by this experiment reveal a strong influence of the preheating on the results of the main discharge. The phenomena in the preheating phase are described in detail. During the main discharge a cusp shaped plasma is produced with electron densities up to 5×10^{17} cm^{-3} at electron temperatures between 10 and 70 eV. ESRO

N67-13048# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.
VERY DENSE PLASMAS IN THE THOMAS–FERMI STATISTICAL MODEL
G. Lehner Apr. 1966 22 p refs
(LGI-66-8) CFSTI: HC$1.00/MF$0.50

For very high pressures the degree of ionization of a plasma cannot be calculated from the Saha equation; instead the Thomas–Fermi statistical model of the atom is used. This model yields the energy distribution of electrons in a self consistent potential surrounding the nucleus, and one calculates the number of free electrons having sufficient energy to overcome the potential barrier at the surface of the atom. Two cases are discussed: the simple Thomas–Fermi model for zero temperature and its generalization to nonzero temperature. Author (ESRO)

N67-13054# Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics Div.
AURORAL ELECTRIC FIELDS
Rolf Bostroem Aug. 1966 20 p refs Presented at Advanced Study Inst, "Aurora and Airglow", Keele, England, 1966
(Rept.-66-15) CFSTI: HC$1.00/MF$0.50

Various mechanisms for the production of electric fields in the magnetosphere and ionsphere are reviewed. The motion of visual and radio aurora and the currents in the ionosphere are related to these fields. The possibilities to deduce the fields from auroral observations are discussed. The importance of the coupling between the ionosphere and outer magnetosphere is stressed. Author (ESRO)

N67-13055# Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics Div.
DIFFUSION DUE TO ION–ION COLLISIONS IN A MULTICOMPONENT PLASMA
Bjoern Bonnevier Jun. 1966 41 p refs Submitted for Publication
(Rept.-66-07) CFSTI: HC$2.00/MF$0.50

Diffusion due to ion–ion collisions between different ion species is considered. Special attention is paid to diffusion of impurities in rotating plasmas. It is shown that impurity ions in many cases are centrifuged out to the plasma border. The possibility to use rotating plasmas for isotope separation is discussed. Another application of interest is the distribution of ions in the topside ionosphere. Author (ESRO)

N67-13101*# California Univ., La Jolla.
PHYSICAL PROCESSES IN AN MPD ARC First Semiannual Report
R. H. Lovberg 29 Nov. 1966 17p
(Grant NGR-05-009-030)
(NASA-CR-80452) CFSTI: HC$1.00/MF$0.50 CSCL 20I

An accelerator and its associated vacuum facility was constructed. The accelerator was operated with argon propellant, and an initial survey of its impedance characteristics was made. Results of these tests are summarized. The general engineering features of the device itself, in terms of problems arising from project criteria and the solutions to them, are outlined. Probes were used as the main diagnostic tool to determine, as far as possible, the interior physical characteristics of a maximum permissible dosage arc. The current flow was held to short pulses. The various components of the systems which are described in some detail, are accompanied by photographs of the components. L.S.

N67-13127*# Yeshiva Univ., New York. Belfer Graduate School of Science.
NON-LINEAR WAVES IN PLASMAS AND DISK-LIKE GALAXIES

Gideon Carmi Jun. 1966 42 p refs
(Grant NGR-33-023-009; NSF GP-3171; Contract AF 19(628)-4381)
(NASA-CR-80486) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Consideration is given to a simple model for a disk-like galaxy, the counterpart to a nonlinear cold plasma, to show that the analogy between cooperative waves in plasmas and in systems involving gravitational interaction extends beyond the domain of linear approximations. The method proposed is useful only as far as it can be carried exactly and merely to indicate the possible approximation procedures that may be taken to continue the solution. Exact solutions can be obtained in the Eulerian representation, whereas other treatments use the Lagrangian representation in varying degrees. S.P.

N67-13143# Weapons Research Establishment, Salisbury (Australia).
THE INFLUENCE OF THERMIONIC EMISSION VELOCITIES ON THE CUT-OFF CHARACTERISTICS OF A CYLINDRICAL MAGNETRON
E. H. Hirsch Aug. 1966 12p refs
(WRE-TN-CPD-117) CFSTI: HC $1.00/MF $0.50

It is shown that under normal operating conditions the effect of initial electron velocities is too small to account for observed deviations from the predictions of the Hull theory. Author

N67-13149# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Energiewandlung und Elektrische Antriebe.
SPECTROSCOPIC INVESTIGATIONS OF AN HF-PLASMA SOURCE [SPEKTROSKOPISCHE UNTERSUCHUNGEN AN EINER HOCHFREQUENZPLASMAQUELLE]
Siegfried Kelm, Wilfried Seeger, and Vera Jawtusch Sep. 1966 57p refs In GERMAN; ENGLISH summary
(DLR-FB-66-61; DVL-550) CFSTI: HC $3.00/MF $0.50

A steady state HF-discharge was investigated, which was produced in a torus by the HF-field of a special coil. Several noble gases were used for the plasma source within a pressure range from 0.1 to 14 Torr. The electron temperature, the electron density and other quantities of the plasma has been determined by spectroscopic methods. As in our case the coronal domain is valid, a new method had to be used for evaluating the plasma parameters from the spectroscopic measurements. The electron temperature reached values up to 40,000° K, and the electron density was in the range from 10^{13} to 10^{15} cm^{-3}. The electrical conductivity was evaluated to be in the order of 10^{14} mho/m. Author

N67-13152# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF THE PLASMA COLUMN IN HOLLOW-ELECTRODE ARC [ETUDE DE LA COLONNE DE PLASMA DANS UN ARC A ELECTRODES CREUSES]
Renato Cano, Mario Mattioli, and Bruno Zanfagna Brussels, EURATOM, Aug. 1966 68 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-007-62-1 FUAF)
(EUR-2645.f; CEA-R-2935) CFSTI: HC $3.00/MF $0.75

A steady state hollow electrodes arc has been built. The density of the plasma column obtained varies between $1.5 \cdot 10^{13}$ cm^{-3} and $8 \cdot 10^{14}$ cm^{-3} when the argon feed rate is varied from 0.2 and 30 1/h S.T.P. and the corresponding values of the electron temperature vary from at least 15 eV to 1 eV. Three diagnostic methods have been utilized: electrostatic probes, far-infrared emission (wave length between 10 and 0.1 mm) and microwave techniques utilizing either the transmitted or the reflected wave. The results obtained are described in detail and compared. Limits of utilization of the different techniques are given. Author

N67-13222*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MOTION OF MAGNETIC FIELD LINES
David P. Stern Jun. 1966 57 p refs
(NASA-TM-X-55584; X-640-66-272) CFSTI: HC $2.50/MF $0.50 CSCL 20I

The definition and applications of the motion of magnetic lines of force are reviewed and illustrated. First, the concept of such a motion is introduced as an aid to describing the evolution of a known magnetic field. It is next shown that a known velocity field in a perfectly conducting fluid with embedded magnetic field may be regarded as describing the velocity of the magnetic field lines there. The consequences of such a flow on the field are then derived, including the properties of flux and line preservation and Cauchy's general solution. The discussion is then extended to fluids having a finite high conductivity, with accent on the role of X-type neutral points in the magnetic field. The review concludes with a brief description of existing theories on the behavior of such neutral points. Author

N67-13241# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
WORK REPORTS OF THE THEORETICAL AND EXPERIMENTAL GROUPS FOR 1964 [ARBEITSBERICHTE DER THEORETISCHEN UND EXPERIMENTELLEN GRUPPEN FUER DAS JAHR 1964]
K. Vogelbruch, comp. Apr. 1965 115 p refs In GERMAN
(JUL-264-PP) CFSTI: HC $1.00/MF $0.50

The Institute's main activities concern production, heating and confinement of plasma at thermonuclear temperatures and high densities by means of preheating, shock wave heating and adiabatic magnetic compression. With a similar experimental technique preheated plasmas can be accelerated in pulsed inhomogeneous magnetic fields. A large Theta Pinch machine and a smaller magnetic compression experiment in cusp geometry were completed and made operational in 1964; the results obtained are described. Further development of a large compression experiment with incorporation of a cusp coil system, a 40 kV shock wave experiment, a 2-stage-transient wave accelerator and a power-crow-bar system for the 10 kJ/20 kV cusp experiment are being planned and designed. Theoretical work on the one-dimensional Vlasov equation, particle acceleration, motional phenomena in a linear plasma accellerator and adiabatic invariance during particle motion in one-dimensional fields was completed. Research on the Stark effect in statistical electric fields, the boundary layer between plasma and magnetic field as well as on irreversible thermodynamics has been continued. New studies have been started on kinetic theory of plasma in the radiation field, on non-adiabatic particle tracks in the Theta Pinch and the calculation of one-dimensional pulsed magnetic fields. ESRO

N67-13242# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
WORK REPORTS OF THE THEORETICAL AND EXPERIMENTAL GROUPS FOR 1965 [ARBEITSBERICHT DER THEORETISCHEN UND EXPERIMENTELLEN GRUPPEN FUER DAS JAHR 1965]
K. Vogelbruch, comp. Jun. 1966 110 p refs In GERMAN
(JUL-381-PP) CFSTI: HC $4.00/MF $1.00

A 40 kV–15 kJ Theta Pinch experiment with extremely low inductivity was completed in the end of 1965. By means of a special circuit ignition problems of non pre-ionized H_2 through transient waves and those of plasma acceleration could be solved. The large Theta Pinch experimental set-up was equipped with a large vacuum switch. A 1 m-grating spectrometer with grazing incidence for soft X-rays between 20 Å and 600 Å was developed. Results obtained in 1965 with the large and small Theta Pinch experiments, the cusp compression experiment, the plasma acceleration measurements through individual half

cycles of a transient wave, and low inductivity condenser batteries are given. A first experiment for tests on non-linear waves was started and a pulsed 3-stage transient wave accelerator is planned. Theoretical work was completed on: stability properties of plasma configurations invoking the Vlasov theory, square Stark effect in statistical electric fields, and numerical calculation methods for pulsed one-dimensional magnetic fields. ESRO

N67-13245# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANNUAL REVIEW, APRIL 1965–MARCH 1966
Mar. 1966 103 p refs
(AD-489865) CFSTI: HC $4.00/MF $0.75

Plasma physics technological developments are reported for: ion cyclotron resonance heating of plasma, theoretical investigation of unsteady plasma flow, vacuum system, particle detector, plasma production, heliotron C device, electron heating in magnetic bottle, probe noises of quiet plasma, infrared gas laser, deformation of a magnetohydrodynamic nozzle flow due to external magnetic field, the electromagnetic instability of an extremely hot electron plasma with anisotropic velocity distribution, and related topics. Mathematical expressions, schematics and tabulated data are presented to complete the descriptive details. R.U.

N67-13319# Oak Ridge National Lab., Tenn.
THERMONUCLEAR DIVISION Semiannual Progress Report, Period Ending 30 Apr. 1966
A. H. Snell et al Aug. 1966 164 p refs
(Contract W-7405-ENG-26)
(ORNL-3989) CFSTI: HC $5.00/MF $1.00

Separate abstracts were prepared for the eleven included sections. NSA

N67-13328# Stanford Univ., Calif. Inst. for Plasma Research.
GROWTH OF FLUCTUATIONS IN A COLLISIONLESS PLASMA SUBJECTED TO AN ELECTRIC FIELD
Lewis M. Linson May 1966 225 p refs
(Contract AT(04-3)-326)
(SU-IPR-49) CFSTI: HC $6.00/MF $1.25

An analytic representation of the time-behavior of the fluctuating fields $E_k(t)$ in a non-stationary, collisionless plasma is derived. The specific case treated is that of a uniform, constant electric field E_0 which is large enough to excite the two-stream instability when applied to a uniform plasma. The basic equation solved is the inhomogeneous Volterra integral equation for the fluctuating electric fields derived by Fried et al., on the basis of the linearized Vlasov equation. The technique developed is applicable for plasmas whose velocity distribution functions lead to a polynomial dispersion function; the integral equation can then be converted into an inhomogeneous differential equation for the fluctuating fields. Cold plasma and a plasma whose velocity distribution functions are resonance-shaped are discussed; the resulting differential equations are of fourth order. Besides being capable of dealing with more general distribution functions, the technique can also be generalized to include non-steady applied fields as well as situations in which the relative velocity between the species comprising the plasma has arbitrary time behavior. NSA

N67-13340# Stanford Univ., Calif. Inst. for Plasma Research.
STUDY OF THE DIFFUSION PROCESS IN A TOROIDAL DISCHARGE
R. Le Bail and D. Pigache May 1966 27 p refs
(Contract AT(04-3)-326)
(SU-IPR-69) CFSTI: HC $2.00/MF $0.50

The diffusion rate of a plasma across a magnetic field was measured in a toroidal, pulsed d.c. discharge, and also during the afterglow. During the pulse the measured diffusion coefficient decreases by about a factor 2 when the magnetic field is increased from 200 gauss to 400 gauss and remains approximately constant between 400 gauss and 800 gauss. It appears to be higher than it should be according to collisional diffusion theory, by a factor 10 at 200 gauss and 100 at 800 gauss. During the afterglow, the diffusion rate is definitely one order of magnitude slower than during the discharge. The poor accuracy of the measurement during the afterglow does not permit, however, to decide whether the diffusion is purely collisional or somewhat faster. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N67-12322# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
INVESTIGATION ON SEMICONDUCTING DIAMONDS
R. Chen Jun. 1966 17 p refs Submitted for Publication
(Contract AF 61(052)-759)
(SR-6; AFCRL-66-560; AD-637869) CFSTI: HC $1.00/MF $0.50

Some luminescence phenomena typical of semiconducting diamonds was investigated. The main thermoluminescent and phosphorescent emission was found to be blue (the TL peaks appeared at 150k and 260k), as observed in the case of photoluminescence and electroluminescence. The blue emission was excited by uv light between 2250A and 4000A. Excitation of the 260k peak was superlinear for some excitation wavelengths, and this peak could not be bleached by infrared light. The 150k peak intensity seemed to be linear with the dose, and under certain conditions bleaching effects appeared. Visible and infrared light applied to the crystal before the uv irradiation caused an interesting change in the blue TL peak intensities, reducing the intensity of the 150k peak and enhancing (sometimes quite markedly) the 260k one. Red peaks at 175k and 280k could be excited by uv and visible light, the excitation being linear or sublinear with dose. Decay curves of phosphorescence were of the becquerel form, with the power varying between 0.5 and 1.5. These results have an important bearing on the energy levels in the forbidden energy gap of semiconducting diamonds, and on transitions between them. A possible use of these phenomena is as a relatively easy means of selecting the rare semiconducting samples (among which are the blue diamonds), out of the common diamond variety. Author (TAB)

N67-12367# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF EXCITONS OF LARGE RADIUS IN CRYSTALS WITH DEGENERATE ZONES
A. G. Zhylich and V. P. Makarov *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 30-54 refs (See N67-12364 03-08) CFSTI: HC $6.00/MF $1.25

Hole mobility, and the theory of large range excitons in crystals, which have the electron and the hole bands (or one of them) degenerate at the point $\vec{k}=0$, are examined. Complete exciton wave functions were constructed, differing slightly from known exciton functions. The general methods with some assumptions referring to the band structure are applied to the excitons of the so-called yellow series in the crystal Cu_2O. Exciton functions of different symmetry are constructed in this crystal, and selection rules for ortical forming of the excitons are considered. The Zeeman-effect on the lines of the yellow series is theoretically investigated, and the results compared with experimental data. R.U.

N67-12368# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ORIGIN OF NEW LINES IN THE ABSORPTION SPECTRUM OF CUPROUS OXIDE CRYSTALS
N. V. Starostin *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 55–60 refs (See N67-12364 03-08)
CFSTI: HC$8.00/MF$1.25

On the assumption that in a cuprous oxide crystal there are Fenkel's excitons of both quasiatomic and quasimolecular types, an attempt is made to explain the origin of the lines between the terms of the yellow exciton series. The considered types of exciton states were associated with local excitation, not extending beyond the limits of one unit cell. A generalization is made from this, and it is extended to the possibility that the continuation of narrow absorption lines in cuprous oxide crystal can be observed up to the lower boundary of continuous spectrum. R.Li.

N67-12371# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMULA FOR ENERGY OF MANY-ELECTRON SYSTEM WITH UNFILLED LAYER
A. A. Kiselev *In its* Herald of Leningrad Univ., Phys. and Chem. Ser. 13 Apr. 1966 p 75–81 refs (See N67-12364 03-08)
CFSTI: HC$8.00/MF$1.25

With the aid of the symmetric orthogonalization method, formulas were derived for the energy of many-electron system with unfilled layer. When large unorthogonality integrals appear, summation of the series of equations is difficult and it is necessary to use other methods of orthogonalization and other energy formulas. It is stated that the energy formula may be useful in considering the ground and excited states of some color centers in crystals. R.Li.

N67-12456# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
OSCILLATOR ANALYSIS OF LiF AND MgO REFLECTIVITY Interim Report
Alfred Kahan May 1966 54 p refs *Its* Phys. Sci. Res. Paper No. 229
(AFCRL-66-327; AD-638793) CFSTI: HC$3.00/MF$0.50

Classical oscillator thoery is applied to the analysis of the fundamental lattice vibration reflectivity spectrum of LiF and MgO in the 200 to 800/cm wave-number range. For each material seven reflectivity curves, ranging from 7.5 to 1060K for LiF and from 8 to 1950K for MgO, are analyzed and the associated dispersion parameters as a function of temperature obtained. The reflectivity curves of both LiF and MgO can be fitted with two resonances at all temperatures. Resonance frequencies NU_1 and NU_2 are decreasing functions, whereas strengths $4\pi p_1$ and $4\pi p_2$ are increasing functions of temperature. At the higher temperatures, the width of the main resonance γ_1 obeys a T(1.0) power law for LiF and a T(1.5) law for MgO. In addition, optical constants, real and imaginary parts of the dielectric constant, and absorption coefficients are calculated as functions of wave number and temperature. A description of the classical analysis computer program is included, together with input requirements and Fortran IV listings.
Author (TAB)

N67-12458# Lockheed Missiles and Space Co., Palo Alto, Calif. Materials Sciences Lab.
ELECTRONIC STRUCTURE OF ZINC OXIDE AND RELATED CRYSTALS Quarterly Status Report, 1 May–31 Jul. 1966
Frank Herman 31 Jul. 1966 6 p
(Contract AF 33(615)-5072)
(QSR-1; AD-638482) CFSTI: HC$1.00/MF$0.50

The aim of this investigation is the elucidation of the electronic energy band structure of zinc oxide and related wurtzite-type crystals, including alloys of zinc oxide and zinc sulfide; zinc sulfide; zinc selenide; and zinc telluride. The principal features of the band structures of these crystals will be determined, and these features will be related to important optical and electronic properties. An attempt will be made to understand the systematic variation of band structure with chemical composition in the sequence ZnO, ZnS, ZnSe, ZnTe, as well as the relationship between the band structures of the cubic and hexagonal modifications of a crystal such as ZnS.
Author (TAB)

N67-12491# Library of Congress, Washington, D. C. Aerospace Technology Div.
ULTRAHIGH PRESSURE STUDIES AND CRYSTAL GROWTH TECHNIQUES Surveys of Foreign Scientific and Technical Literature
John J. Kourilo 17 May 1966 64 p refs Analytical Survey
(ATD-66-56; AD-635495) CFSTI: HC$3.00/MF$0.75

This report is divided into two main parts (analytical evaluation of data and annotated bibliography), each having three sections. The three sections are: general studies, ultrahigh pressure studies, and crystal growth techniques, in that order. Section 3 was further subdivided, for the purpose of retrieval, into six chapters according to the category of the growth technique. The chapters are: A. Growth from melts; B. Growth from solution (flux); C. Hydrothermal growth; D. Growth from vapor phase; E. Epitaxial growth of thin films; F. Other growth techniques. The report includes material dealing with ultrahigh pressure studies and techniques of single crystal growth (including deposition of single crystalline thin films) of the elemental semiconductors and semiconducting, lasing, luminescent, ferroelectric, ferromagnetic, piezoelectric, dielectric, and other inorganic compounds which may be of interest for aerospace technology.
Author (TAB)

N67-12812# India. Dept. of Atomic Energy, Bombay.
GENERATION–RECOMBINATION NOISE AND ITS INFLUENCE ON THE ENERGY RESOLUTION OF DIFFUSED SILICON P–N JUNCTION RADIATION DETECTORS
R. Y. Deshpande *In its* Proc. of the Nucl. Phys. and Solid State Phys. Symp., Nucl. Phys. 1966 p 334–338 refs (See N67-12541 03-24)
CFSTI: HC$7.32/MF$2.00

Investigations of the nature and origin of detector noise and the effect of pulse shaping networks on resolution are presented. The origin of noise is traced to the basic process going on in a reverse-biased p–n junction. It is suggested that the recombination–generation processes through the agency of deep recombination centers are responsible for the detector noise. The statistics of these processes are worked out and results are compared with the experimentally observed energy resolutions. S.P.

N67-12643# Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS Quarterly Progress Report, Apr.–Jun. 1966
Hubert E. Caspers, John C. Hoffman, and Howard E. Rast 15 Aug. 1966 42 p refs
(NOLC-672; AD-637864) CFSTI: HC$2.00/MF$0.50

Fluorescence and infrared absorption of Sm^{3+} in LaF_3, by H. E. Rast and H. H. Caspers: The fluorescence spectrum was observed in the spectral range of 0.55 to 1.1 micrometer, and the infrared absorption spectrum was recorded from 0.90 to 10.0 micrometer. The two lowest terms, 6H and 6F, give rise to 12 spin-orbit split multiplets. Transitions have been observed terminating on at least 10 of the 12 multiplets. The experimentally determined barycenters of the crystalline Stark components have been fitted to a 'free-ion' calculation of the energy levels in terms of the Slater integral F2 and Zeta(4F), assuming

pure Russell-Saunders coupling. Continuous slot antenna, by: J. G. Hoffman: The perturbation of the waveguide phase constant caused by a continuous slot in the broad face of a waveguide is discussed. The effects of this perturbation are presented in graphical form, together with an analytical verification of the experimental results. Author (TAB)

N67-12646# Naval Research Lab., Washington, D. C.
LASER MATERIALS RESEARCH
H. W. Gandy, R. J. Ginther, and J. F. Weller *In its* NRL Progr. in High-Power Laser Res. 10 Jun. 1966 p 1–13 refs (See N67-12645 03-16) CFSTI: HC $2.00/MF $0.50

The main effort in laser materials research was directed toward the study of energy transfer in double and triple activated glasses, its manifestations in stimulated emission processes, and equipment development for these studies. Sequential two-step energy transfer was found in a barium crown glass matrix from UO_2^{2+} to Nd^{3+} to Yb^{3+} and established the necessity of a bridging ion. Both sequential and parallel radiationless energy transfer was observed in a lithium magnesium aluminosilicate glass. Stimulated emission processes in multiple activated glass etalons were observed in the Yb^{3+} to Ho^{3+} transfer laser; as much as a tenfold decrease in the Ho^{3+} laser threshold was found with the incorporation of Yb^{3+} in the etalon glass. Larger bursts of oscillations from glass etalons were produced by introducing a recoverable loss in the etalon itself; self Q-switching stimulated emission outputs of Er^{3+}, Yb^{3+}, Nd^{3+}, and Ho^{3+} by utilizing saturable absorption at the respective wavelengths. The simplest type of self Q-switching was observed in silicate glass singly activated with Er^{3+} at 80°K. Self-Q-switching of Nd^{3+} stimulated emission was found in Ce^{3+}, Nd^{3+} activated etalons at low temperatures after the etalon had been exposed to uv radiation. G.G.

N67-12647# Naval Research Lab., Washington, D. C.
LASER MATERIALS EVALUATION PROGRAM
W. H. Vaughan *In its* NRL Progr. in High-Power Laser Res. 10 Jun. 1966 p 14 (See N67-12645 03-16) CFSTI: HC $2.00/MF $0.50

Described is the assembly of equipment to measure the static scattering loss of materials intended for high-powered lasers. The method that is being used involves placing the sample in an integrating sphere; light from the sample is then compared to a known light source. A photomultiplier in conjunction with a phase-sensitive detector is utilized as a null instrument. G.G.

N67-12718*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTRAL EMISSIVITY OF HIGHLY DOPED SILICON
Curt H. Liebert Washington, NASA, 1966 33 p refs To be presented at the Thermophys. Specialists Conf. sponsored by the Am. Inst. of Aeron. and Astronautics, New Orleans, 17–19 Apr. 1967
(NASA-TM-X-52254) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Spectral normal emissivity of opaque silicon, highly doped with arsenic and boron, was measured at temperatures of 300°, 882°, and 1074°K. At 300°K, emissivity data were obtained at wavelengths from 2.6 to 35 microns; at the higher temperatures from 3.5 to 14.8 microns. Carrier concentrations determined from Hall measurements made at 300°K and direct current resistivity measured from 300° to 1200°K were used in calculating the emissivities. Good agreement with free carrier absorption theory was achieved for both p-type and n-type silicon at all of the investigated wavelengths and temperatures; and agreement with the Hagen–Rubens theory was found at wavelengths greater than 12 microns and at 300°K. Values for index of refraction and absorption index, used for the prediction of emissivity by the free carrier absorption (FCA) theory, are presented; and it was concluded that FCA theory can be used with reasonable accuracy to obtain these indexes for opaque media. Special attention is given to the procedure for minimization of errors during these experiments. M.W.R.

N67-12888# United Kingdom Atomic Energy Authority, Culham (England).
ENERGY LOSS BY LOW ENERGY PROTONS IN GOLD
A. H. Morton, D. A. Aldcroft, and M. F. Payne Jul. 1966 15 p refs Submitted for Publication
(CLM-P107) CFSTI: HC $1.00/MF $0.50

An experiment employing a new method of measuring stopping power at low energies is described and results given for protons on gold. dE/dx values for protons on gold have been obtained from measurements of the response of a silicon surface-barrier detector, covered with a surface layer of gold, to protons of energy below 50 keV. The response of the detector to H_2^+ and H_3^+ ions in the same energy range has been used to determine backscattering cross sections for protons on gold. Author

N67-12913*# Radio Corp. of America, Camden, N. J. Applied Research Dept.
STUDY OF PROPERTIES OF HIGH-FIELD SUPERCONDUCTORS AT ELEVATED TEMPERATURES Final Technical Report, 27 Apr.–26 Aug. 1966
D. A. Gandolfo and C. M. Harper 7 Oct. 1966 33 p refs
(Contract NAS8-11272)
(NASA-CR-80154) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Magnetization experiments on specimens of Nb_3Sn, NbTi, and Nb are reported. The Nb_3Sn specimens were pressure sintered, and one of them contained a ferrimagnetic inclusion. To our knowledge results on such a specimen have not been reported before. Values of the critical state parameter, α, as a function of temperature were obtained. The NbTi specimen was cast and cold worked. Values of α and the threshold for ac field-induced flux jumps were obtained before and after a 400°C heat treatment. An improvement in both quantities by a factor of more than 2 was observed. The Nb sample was also cast and cold worked. For H near H_{c2} the supercurrent in this specimen was very stable against ac field-induced flux jumps, while for H somewhat less than H_{c2} behavior in superimposed ac and dc fields resembled that of NbTi. Recommendations for further effort are given. Author

N67-12926*# Stanford Univ., Calif. Dept. of Materials Science.
MECHANICAL BEHAVIOR OF POLYCRYSTALLINE NON-METALLICS AT ELEVATED TEMPERATURE Progress Report, Apr. 1–Sep. 30, 1966
Oleg D. Sherby and Peter Burke 30 Sep. 1966 17 p refs
(Grant NGR-05-020-084)
(NASA-CR-80102) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Research progress in the area of mechanical behavior of polycrystalline nonmetallics is reported. Modifications of two dead load compression creep units are enumerated, and new equipment for density measurements is described. Other topics considered are diffusion in sodium chloride, Young's modulus of sodium chloride, creep of sodium chloride, creep of sodium chloride–potassium chloride, and mechanical behavior of solids at elevated temperature. S.P.

N67-12975*# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
ESCAPE DEPTH FOR EXCITED PHOTOELECTRONS IN KBr FILMS
William Pong [1966] 14 p refs
(Grant NsG-328)
(NASA-CR-80149) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Quantum yields for backward and forward photoemission from evaporated KBr films have been measured as a function of film thickness. From the results of photoelectric yield measurements, the attenuation length for photoelectrons excited at $h\nu = 10.2$ eV was found to be approximately 180 Å, which is slightly greater than the absorption length for the photons. The measured attenuation length was used to estimate the mean free path for electron-phonon collisions. Author

N67-12985*# Case Inst. of Tech., Cleveland, Ohio.
IMPURITIES AND INTERFACE STATES IN THE SiO_2/Si SYSTEM Semiannual Report
Alan B. Kuper 15 Oct. 1966 36 p refs
(Grant NGR-36-003-067)
(NASA-CR-80350) CFSTI: HC$2.00/MF$0.50 CSCL 20L

Research is being conducted to determine factors contributing to instability in surface properties of silicon planar devices and to provide information for improving the reliability of the devices. Sodium migration in the oxide is being studied because of its importance as a failure mechanism. Combined MOS electrical/radiochemical analysis is the principal experimental method. This gives a direct measurement of impurity distribution that underlies electrical instability data. Research includes: impurity diffusion and drift, P_2O_5–SiO_2 glass stabilization, impurity interaction, and theory of impurity distribution. Results are in the form of impurity distribution profiles within SiO_2 compared with electrical Si surface data on the same samples. Results in device processing show that Na is evaporated from within SiO_2 at above 800°C in dry nitrogen, closely stacked wafers evaporate Na at an appreciably slower rate, and P_2O_5 gettering is partly an interface effect. Test results show that Na may remain near the Si interface in hot bias tests even though the SiO_2 appears clean electrically, and anion may partly cancel Na^+ after high temperature processing. Author

N67-12999*# Western Reserve Univ., Cleveland, Ohio.
[FUNDAMENTAL STUDIES ON SEMI-CONDUCTOR RADIATION DETECTORS] Semiannual Status Report, Mar. 1–Aug. 31, 1966
Karl J. Casper 31 Aug. 1966 24 p
(Grant NsG-655)
(NASA-CR-80371) CFSTI: HC$1.00/MF$0.50 CSCL 20L

Research performed during this period on silicon and germanium detectors is reported. Work on the large volume lithium drifted germanium detectors is described and includes the preparation of the crystal for diffusion and drift and the diffusion and drifting processes. Other efforts described include tests of large volume silicon detectors, and measurements of the temperature dependence of the energy resolution of the silicon detectors. R.N.A.

N67-13001*# National Bureau of Standards, Washington, D. C.
REPORT ON THE CALIBRATION OF A PHOTOELECTRIC STANDARD FOR HARVARD COLLEGE OBSERVATORY
R. P. Madden, L. R. Canfield, and R. G. Johnston [1965] 8 p refs
(NASA Order R-73)
(NASA-CR-79393) CFSTI: HC$1.00/MF$0.50 CSCL 20L

The photoelectric yield of a 2.6×1.3 cm sample of tungsten has been measured at the wavelengths 584 Å, 735 Å, 1048 Å and 1216 Å. The yield was determined by measuring the ratio of the number of photoelectrons ejected per second to the number of photons per second striking the sample. The photon flux was measured with a calibrated thermopile at each wavelength and checked against a rare gas ionization chamber at 584 Å and 735 Å. Corrections were made to the thermopile results to account for intensity distributions, the variation in sensitivity along the surface of the thermopile and the effective loss of sensitivity (2–6%) due to photoelectrons being ejected from the thermopile. Author

N67-13068# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRO-OPTIC CRYSTALS AND THEIR USE FOR LIGHT MODULATION
Alan R. Johnston *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 129–164 refs (See N67-13061 03-23)
CFSTI: HC$5.11/MF$2.00
(Contract NAS7-100)

Several methods of modulating a beam of light utilizing the influence of an electrical signal on the birefringence of certain crystals, are reviewed. These employ optics which respond to the state of polarization of a light beam, and include intensity modulation, position modulation, and the possibility of an electrically tuned optical filter. The influence of the piezo-optic, or strain contribution to the total electro-optic response in the design of an optoelectronic device is discussed. Current experimental work in our laboratory in which the strain contribution is separated from the direct effect is described. The magnitudes of the electro-optic effect, dielectric constant, and other related properties are compared for several materials potentially useful as electro-optic modulators, and some comments are made about the practical problems of building a modulator. Author

N67-13076# Paris Univ., Orsay (France). Inst. of Electronics.
RAPID EXTRACTION OF PERIODIC SIGNALS BY PHOSPHOR RECORDING [EXTRACTION RAPIDE DES SIGNAUX PERIODIQUES PAR MEMOIRE A PHOSPHORESCENCE]
J. N. Aubrun *In* AGARD Optoelectron. Components and Devices Sep. 1965 p 295–304 refs In FRENCH; ENGLISH summary (See N67-13061 03-23) CFSTI: HC$5.11/MF$2.00

The properties of phosphors can be used to obtain the mean of N cycles of a signal which is swamped in a noise, which reduces the ratio of N. Each phosphorescent crystal behaves as a low pass filter with respect to the eight fluxes which are received and then re-emitted. By recording on the same phosphorescent track repeated cycles of the signal, the light flux re-emitted by a point in the track is proportional to the mean value of the signal corresponding to a given phase. The equipment developed has a drum covered with a phosphorescent body and driven by a synchronous motor at the frequency of the signal. A light modulator shows on the track the image of a slot, the illumination of which is proportional to the input signal plus noise. A photomultiplier behind a slot parallel to the first slot and diametrically opposed permits read-out of the signal extracted at the same frequency as the incident signal. This device achieves at the present time an improvement of 30 dB and transmits 200 harmonics of the signal without distortion, irrespective of its recurrence frequency. Author

N67-13103*# Naval Ordnance Lab., White Oak, Md.
SOLID STATE RESEARCH OF THE APPLIED PHYSICS DEPARTMENT FOR THE YEAR 1965
Wayne W. Scanlon 29 Jun. 1966 58 p refs Sponsored in part by NASA
(NASA-CR-80478; NOLTR-66-139) CFSTI: HC $3.00/MF $0.50 CSCL 20L

Basic research efforts in the fields of magnetism and semiconductors, and applied research in infrared and metallurgy are reviewed. Semiconductor research continues to be concentrated on small band gap materials for use as infrared detectors, sources, or filters. This work was extended to still smaller energy gap materials (e.g. tin telluride) that border on metallic behavior. A technique for making thin single crystal films by epitaxial vacuum evaporation was developed, which is particularly useful in studying alloy compositions used in semiconductors. Research in metallurgy included studies of the crystal structure of the family of alloys TiFe, TiCo, and TiNi. A unique martensitic transition was found in all these metals. The magnetic behavior of the alloys was studied, and anisotropy in rare earth metals is being studied in magnetic

fields up to 140 kOe. The antiferromagnetic structures of MnP, $EuTiO_3$, and Rb $MnCl_3$ were established by neutron diffraction studies. Other research efforts discussed include: the optical transmission of water in the highest transmission vicinity, the green wavelength; electron irradiation treatments of low coercive force Ni–Fe alloys; and shock waves in water from high intensity laser radiation impingement on the water. Other research efforts are also discussed. L.S.

N67-13139# National Bureau of Standards, Washington, D. C.
SUPERCONDUCTIVE MATERIALS AND SOME OF THEIR PROPERTIES
B. W. Roberts (GE, Schenectady, N. Y.) 26 Sep. 1966 73 p refs
(NBS-TN-408) GPO: $0.45

A noncritical compilation of data on superconductive materials that has been extracted from the literature published between October 1963 and December 1965 is presented. The properties concerned are composition, critical temperature, critical field crystallographic data, and lowest temperature tested for superconductivity. The compilation also includes, bibliography, general reference review articles, and a special tabulation of high magnetic field superconductors. Author

N67-13263# Wisconsin Univ., Madison. Dept. of Physics.
EFFECTS OF IRRADIATION TEMPERATURE IN LiF(TLD-100)
L. A. De Werd and J. R. Cameron 15 Jul. 1966 10 p refs
(Contract AT(11-1)-1105)
(COO-1105-118) CFSTI: HC $1.00/MF $0.50

Experimental results are presented on the effects of irradiation annealing on the thermoluminescence on LiF(TLD-100) at 290 and −54°C. The results are compared to previous results reported for room temperature irradiations. NSA

N67-13264# Wisconsin Univ., Madison. Dept. of Physics.
THE EFFECT OF THE QUALITY OF RADIATION ON THE THERMOLUMINESCENCE OF LiF(TLD-100)
J. Wagner and J. R. Cameron 15 Jul. 1966 8 p refs
(Contract AT(11-1)-1105)
(COO-1105-117) CFSTI: HC $1.00/MF $0.50

The effect of the quality of radiation on the thermoluminescence (TL) of LiF (TLD-100) in a supralinear region of the thermoluminescence vs energy response curve is reported. This energy dependence appears to correlate inversely with the linear ion density produced in the material for the radiation used. In order to test this hypothesis, the number of ion pairs formed per micron was evaluated for several radiation qualities. TL response curves were determined for five photon energies from 25 to 662 kev and for $^{90}Sr-^{90}Y$ beta rays. NSA

N67-13293# Brookhaven National Lab., Upton, N. Y.
DIGITAL CALCULATIONS OF MAGNETIC FIELDS OWING TO CURRENTS IN Nb_3Sn RIBBON IN SUPERCONDUCTING QUADRUPOLE LENS
P. Gerald Kruger, J. N. Synder (Ill. Univ., Urbana), and W. B. Sampson 26 Jul. 1966 12 p ref
(Contract AT(30-2)-GEN-16)
(BNL-10495) CFSTI: HC $1.00/MF $0.50

Digital calculations were made of the magnetic field components due to currents in Nb_3Sn ribbons in superconducting quadrupole lenses. The magnetic field was calculated for radial distance and along distance of the quadrupole axis. NSA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

No abstracts in this issue.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N67-12758*# Vickers, Inc., Detroit, Mich.
PROPORTIONAL SOLID PROPELLANT SECONDARY INJECTION THRUST VECTOR CONTROL STUDY
Washington, NASA, Nov. 1966 283p refs
(Contract NAS1-2962)
(NASA-CR-637) CFSTI: HC $3.75/MF $1.50

Performance characteristics of a proportional hot gas secondary injection thrust vector control (TVC) system were investigated on a high energy solid propellant rocket motor at sea level conditions. Results substantiate theoretical predictions that the injection of a high temperature gas will result in a larger specific impulse and magnification factor; and with a 2000°F gas, specific impulse levels of 330 seconds and a magnification factor of 2.3 were obtained. The degree of TVC applied to the rocket motor can be varied and modulated by a programmed input signal, and the dynamic characteristics of this system are predictable and its control qualities are considered excellent. An axial thrust augmentation of 1 to 2% of the motor thrust was achieved, and the continuous flowing feature of the system produced no adverse effects on the internal aerodynamics of the rocket motor. While no mathematical model has been found to correctly predict all aspects of gaseous secondary injection phenomena, a procedure is presented for the design of a secondary injection TVC system. M.W.R.

N67-13096*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THE DISTRIBUTION OF NEUTRAL ATOMS AND CHARGE-EXCHANGE IONS DOWNSTREAM OF AN ION THRUSTOR
John F. Staggs, William P. Gula, and William R. Kerslake Washington, NASA, 1966 14 p refs Presented at 5th Aerospace Sci. Meeting, New York, 23–27 Jan. 1967; Sponsored by the AIAA
(NASA-TM-X-52259) CFSTI: HC $1.00/MF $0.50 CSCL 21C

In a practical design of an electric-propulsion space vehicle, it is likely that some components, such as a solar-cell array, will be exposed in some degree to neutral atoms and charge-exchange ions leaving the thrustors. This paper describes the energy and angular distributions of such particles emerging from a 15 cm diameter mercury electron-bombardment thrustor. An analytical approach was used to determine the particle effluxes. The results indicate that the erosion and/or coatings due to charge-exchange ions or neutral particle effluxes would be tolerable for several years if components were located outside the primary ion beam and at distances of 75 cm or greater from the thrustor. The value of 75 cm was chosen to simplify the analytical solution. Approximate scaling relations are given that should allow rough determination of particle effluxes for various combinations of nominal operating parameters other than those used in this study. Author

N67-13098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL PERFORMANCE OF A LOW-POWER MPD ARC THRUSTOR
A. E. Johansen, D. N. Bowditch, and J. A. Burkhart Washington, NASA, 1966 17 p refs Presented at 5th Aerospace Meeting, New York, 23–27 Jan. 1967; Sponsored by the AIAA
(NASA-TM-X-52258) CFSTI: HC $1.00/MF $0.50 CSCL 21C

A simple, low-power magnetoplasmadynamic (MPD) arc thrustor has been under investigation. It is light-weight, requires a minimum of power-conditioning equipment, and operates on low voltages which are compatible with a solar cell array. Thrustor development has concentrated on an efficient thrustor with a sturdy, long-lived cathode and lightweight radiation-cooled electromagnets in combination with a permanent magnet. Continuous operation of over 420 hours has been achieved. Thrustor performance has been improved by introducing most of the propellant flow into the anode through a separate feed system and by using xenon gas as the propellant. Results of a parametric survey of various thrustor configurations are presented. The thrustor exhibiting the best performance operated at an average thrust/power ratio of 7 millipounds per kilowatt over a range of thrust values from 0.5 to 1.7 millipounds for specific impulses up to 1300 seconds. Author

N67-13161*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROPELLANT FEED DUCTING AND ENGINE GIMBAL LINES FOR THE SATURN VEHICLE
P. L. Muller, Jr. 4 Nov. 1966 49 p ref
(NASA-TM-X-53532) CFSTI: HC $2.00/MF $0.50 CSCL 21H

The propellant feed system concepts and configurations used on the Saturn V vehicle to convey propellants from the tank to the engine are described. In addition, the engine gimbal lines that provide flexibility for engine gimbaling and, therefore, vehicle control are described from the original concepts used on the Jupiter vehicle through the Saturn I to the more sophisticated systems of the Saturn V. Design and development of propellant feed systems for future vehicles will be based on the Saturn V feed system technology. Author

N67-13193*# General Technology Corp., Torrance, Calif.
MAGNETIC INDUCTION PLASMA ENGINE Final Report
Lee Heflinger, Stuart Ridgway, and Allan Schaffer 5 Apr. 1965 63 p ref
(Contract NAS3-5912)
(NASA-CR-54762) CFSTI: HC $2.50/MF $0.75 CSCL 21C

This report describes the final phase in a magnetic induction plasma accelerator development program. The aim of this development program has been to develop an engine that accelerated a plasma to a velocity corresponding to a specific impulse of 3000 seconds, or more, with good efficiency. Good accelerative coupling had been demonstrated in the previous work between helium plasma and a traveling transverse 450 gauss magnetic field, but with excessive wall interaction. The wall interaction was not significantly reduced by the changes in magnetic field geometry investigated. A theoretical study of the interaction suggests potential improvement by shortening the accelerator. Author

N67-13199*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
RELIABILITY ANALYSES OF MODULAR POWER CONDITIONING AND CONTROL SYSTEMS FOR ION ENGINES Final Report
Oct. 1966 148 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951144)
(NASA-CR-80516) CFSTI: HC $4.00/MF $1.00 CSCL 21C

This is the final report of a reliability analysis of a thermal-vacuum prototype power conditioning and control system which makes use of modularized power conditioning techniques and employs partial redundancy where increased reliability is required. The reliability analysis of this system results in a total probability of success of 0.85 for a 10,000 hour mission. This analysis has helped define areas of the system where substantial reliability improvements can be made with only minor changes in circuit design and virtually no penalty in system weight. The application of these improvements to a proposed flight model optimized for SERT II requirements has yielded the substantially higher reliability of 0.96 for the complete system for a 10,000 hour mission. The analysis has been based on appropriate mathematical models, the best available sources of failure rate data, and detailed component stress calculations. Author

N67-13200*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
DEVELOPMENT AND TEST OF AN ION ENGINE SYSTEM EMPLOYING MODULAR POWER CONDITIONING Final Report
Aug. 1966 139 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951144)
(NASA-CR-80515) CFSTI: HC $4.00/MF $1.00 CSCL 21C

The ultimate objective of the hardware program to be discussed in this report was to demonstrate in a 500 hour life test the operation of a complete engine system (including thruster, feed system, tankage, power conditioning, and engine controls) with a flight weight of less than 25 lb/kW. Initial power conditioning and control system designs were based on anticipated operation with a HRL 20 cm thruster. Later a 15 cm SERT-II type thruster was substituted. This substitution was made with some sacrifice in power conditioning operation and performance. Thus, the final system, which was to be operated completely closed loop in a space simulated vacuum and thermal environment, employed an oxide cathode mercury electron bombardment engine. The tankage, feed system, and power conditioning were designed and developed by Hughes. The primary control system was defined and implemented. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N67-12454# Sacramento Peak Observatory, Sunspot, N. Mex.
AN INVESTIGATION OF THE X-RAY EMISSION OF SOLAR FLARES BY THE RADIO ASTRONOMICAL METHOD
Y. I. Neshpor [1966] 11 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (USSR), v. 29, 1963 p 152–159 (T-28; TT-66-62145; AD-637813) CFSTI: HC $1.00/MF $0.50

The following conclusions are based on a study of the frequency dependence of the attenuation of cosmic radio noise during sudden ionospheric disturbances: (1) The spectral distribution of the X-ray emission intensity of flares varies for each flare; (2) some solar flares are characterized by an appreciable intensity increase of X-ray emission in the short-wave region (0.1-1 A). Author (TAB)

N67-12908*# Volt Technical Corp., Washington, D. C.
MEASUREMENTS OF GAMMA RADIATION OF THE LUNAR SURFACE ON THE SPACE STATION, LUNA-10 [IZMERENIYA GAMMA-IZLUCHENIYA LUNNOY POVERKHNOSTI NA KOSMICHESKOY STANTSII LUNA-10]

A. P. Vinogradov, Yu. A. Surkov, G. M. Chernov, F. F. Kirnozov, and G. B. Nazarkina 26 Sep. 1966 12 p refs Transl. into ENGLISH from Geokhimiya (Moscow), no. 8, 1966 p 891–899
(Contract NAS5-12487)
(NASA-CR-80147; ST-LPS-ACH-10517) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Preliminary results are given of measurements of gamma-radiation of the lunar surface carried out with a scintillation gamma-spectrometer installed on board Luna-10. These measurements covered continental as well as mare regions on both the visible and far side of the Moon. The energy range of the spectra was from 0.3 to 3.1 Mev, and the integral gamma-emission registered at some 15 points was in the same energy range. From the comparison of lunar gamma-spectra with the standard (calibration) spectra for various types of rocks it could be concluded that rocks with the same K, Th and U content as in terrestrial acid rocks (of granite type) are absent in the regions of the lunar surface where measurements were taken. Judging from the experimental data on the intensity of gamma-radiation at the expense of natural radioactivity, it may be referred to the level of intensity from basic type rocks (of basalt type). The obtained levels of concentration of natural radioelements were somewhat overrated. It is interesting to note that tektites, as bodies close in their composition to acid rocks, evidently cannot have a lunar origin.
Author

N67-12912*# Consultants and Designers, Inc., Arlington, Va.
ON THE METHOD OF DETERMINATION OF THE SOLAR COSMIC RAY SPECTRUM IN THE REGION OF HIGH ENERGIES [O METODIKE OPRDELENIYA SPEKTRA SOLNECHYKH KOSMICHESKIKH LUCHEY V OBLASTI VYSOKIKH ENERGIY]
L. I. Dorman and L. I. Miroshnichenko May 1966 11 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 2, 1966 p 215–222
(Contract NAS5-9299)
(NASA-CR-80157; ST-CR-SP-10484) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The results of calculations are presented of the integral generation multiplicity factor for the neutron monitor and the ionization chamber. Calculations for the former were conducted by the latitude effect of the neutron component at sea level. The integral generation multiplicity factor for the ionization chamber was computed by the latitude effect of the flare of 23 February 1956. On the basis of the computed generation multiplicity factors, the spectrum of solar cosmic rays for the flare of 23 February 1956 was obtained at atmosphere boundary.
Author

N67-12919*# Volt Technical Corp., Washington, D. C.
THE INTENSITY OF ELECTRONS AND PROTONS IN THE OUTER RADIATION BELT DURING THE PERIOD 1961–1964 [OB INTENSIVNOSTI PROTONOV I ELEKTRONOV VO VNESHNEM RADIATSIONNOM POYASE V PERIOD 1961–1964 GG.]
S. N. Vernov, I. A. Savenko, M. V. Tel'tsov, and P. I. Shavrin 22 Sep. 1966 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 4, 1966 p 658–660
(Contract NAS5-12487)
(NASA-CR-80163; ST-PF-GM-10516) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Results are presented of near-equatorial measurements in 1964 of the intensity of protons and electrons with respective energies ≥400 keV and > MeV in the center of the radiation belt. These results are compared with analogous data obtained in 1961.
Author

N67-12922*# Consultants and Designers, Inc., Arlington, Va.
NEUTRAL (ZERO) POINTS OF MAGNETIC FIELDS [NEYTRAL'NYYE (NULEVYYE) TOCHKI MAGNITNYKH POLEY]
Yu. D. Zhugzhda 3 Aug. 1966 11 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 3, 1966 p 508–511
(Contract NAS5-9299)
(NASA-CR-80161; ST-PF-GM-10504) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The geometry of a magnetic field is investigated in the immediate vicinity of the neutral points. The complete classification of neutral points of a free field is described in detail. It is shown that the neutral points of a force-free field in the immediate vicinity are reduced to the neutral points of a free field with a precision to the terms of higher orders. The simplest neutral points of a static field are considered.
Author

N67-12927*# Consultants and Designers, Inc., Arlington, Va.
INTENSITY VARIATIONS OF PROTONS AND ELECTRONS OF THE OUTER RADIATION BELT [VARIATSII INTENSIVNOSTI PROTONOV I ELEKTRONOV VNESHNEGO RADIATSIONNOG POYASA]
I. A. Savenko, M. V. Tel'tsov, and P. I. Shavrin 30 May 1966 8 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 2, 1966 p 377–380
(Contract NAS5-9299)
(NASA-CR-80164; ST-PF-GM-10495) CFSTI: HC $1.00/MF $0.50 CSCL 20H

This paper expounds the data processing following the initial analysis of measurements of the outer proton belt conducted by the radiometric devices of "Cosmos-41".
Author

N67-12934*# Columbia Univ., New York. Dept. of Physics and Astronomy.
GRAVITATIONAL RADIATION FROM NEUTRON STARS
Wai-Yin Chau [1965] 20 p refs Submitted for Publication
(Grant NGR-33-008-053)
(NASA-CR-79699) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Gravitational radiation from pulsating and rotating objects is calculated using the formula obtained with the weak field limit of general relativity. The cases of rotation and oscillation are first considered separately, then the effects of rotation on radial oscillations are investigated. Numerical estimates are made with data relevant to a neutron star. It is concluded that most of the energy a neutron star may acquire during its formation is dissipated rapidly, unless the rotation is quite slow.
Author

N67-13006*# Volt Technical Corp., Washington, D. C.
STUDIES OF INTENSITY AND SPECTRAL COMPOSITION OF LUNAR GAMMA-RADIATION ON THE AUTOMATIC STATION LUNA-10 [ISSLEDOVANIYA INTENSIVNOSTI I SPEKTRAL'NOGO SOSTAVA GAMMA-IZLUCHENIYA LUNY NA AVTOMATICHESKOY STANTSII LUNA-10]
A. P. Vinogradov, Yu. A. Surkov, and G. M. Chernov 8 Nov. 1966 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 561–564
(Contract NAS5-12487)
(NASA-CR-80367; ST-LPS-ACH-10533) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A 32-channel scintillation gamma spectrometer was installed on Luna-10 in order to estimate, by gamma radiation, the relative content of potassium, thorium, and uranium in rocks on the lunar surface. The spectrometer included a crystal detector, a photomultiplicator, and a pulse amplitude, for measuring the gamma radiation spectrum on the background of charged particles. The device registered the spectra in two bands: 0.3 to 3.1 MeV, and 0.15 to 1.5 MeV. Band switching was done

by a special command feed on board the station. Preliminary results of the gamma spectra obtained on the orbit of the lunar satellite and on the earth–moon flight trajectory are given. Analysis of the shape of the lunar gamma spectra show that they differ substantially from the terrestrial spectra, where the shape is mainly determined by the content of natural radioactive elements in the rock. For the moon, the basic part of gamma radiation is due to cosmic ray interaction with lunar matter, and to the decay of cosmogenous radioisotopes. Figures depicting the spectra are included. M.G.J.

N67-13063# Rome Univ. (Italy). Lab. of Astrophysics.
PLANETARY RADIATION MEASUREMENTS BY A SATELLITE IN ELLIPTICAL ORBIT [MISURA DELLA RADIAZIONE EMESSA DA UN PIANETA MEDIANTE SATELLITE IN ORBITA ELLITTICA]
F. Di Benedetto Jul. 1966 11 p refs In ITALIAN; ENGLISH summary
(Rept.-66-7) CFSTI: HC $1.00/MF $0.50

A simple formula is obtained which permits the measurement of outgoing radiation from a planet with an atmosphere by means of a satellite in an elliptical orbit, and the reduction to a predetermined height above the active layer of the planet's atmosphere. Author (ESRO)

N67-13067# European Space Research Organization, Paris (France).
OBSERVATIONS OF SOLAR X-RAYS
J. Labeyrie (Comm. a l'Energie Atomique, Saclay, France) Apr. 1966 61 p refs Lecture Given at ESRO Summer School, Alpbach, Austria, 11 Aug., 1965
(ESRO-SM-631) CFSTI: HC $2.50/MF $0.75

A comprehensive review of the measurements of X-rays emitted by the quiet as well as the active sun is presented. Starting with the historic sounding rocket flight by Burnight in 1948 these observations were carried out by means of balloons, sounding rockets and satellites, covering more than one solar cycle. The instruments used as well as the experimental results are discussed in detail. Some experimental and theoretical aspects of solar X-ray observations are considered in general, including absorption of X-rays, production in the solar atmosphere and correlation with geophysical phenomena. Author (ESRO)

N67-13117*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
HIGH ENERGY PRIMARY ELECTRONS AND THE UNIVERSAL BLACK BODY RADIATION
Satya Dev Verma Nov. 1966 11p refs
(Contract NSG-179-61)
(NASA-CR-80438; EFINS-66-108) CFSTI: HC $1.00/MF $0.50

It is shown that in the framework of the galactic halo model, recent measurements of the electron energy spectrum in the 1 GeV to 350 GeV energy interval are compatible with the presence of universal black body radiation (~3.5°K). The lifetime of the halo electrons is estimated to be (1.5~3) $\times 10^{15}$ sec. Author

N67-13130*# Yeshiva Univ., New York. Belfer Graduate School of Science.
STATISTICAL MECHANICS OF CHARGED PARTICLES IN THE PRESSURE OF MAGNETIC IRREGULARITIES
M. Fibich and G. Sandri (Aeron. Res. Assoc. of Princeton, Inc.) Mar. 1966 30 p refs
(Contract NAS5-9159; Grant NGR-33-023-008)
(NASA-CR-80483; ARAP-82) CFSTI: HC $2.00/MF $0.50 CSCL 20H

A model is introduced to describe the interaction of cosmic rays (either of solar or of galactic origin) with the solar wind. The model consists in replacing the magnetic irregularities in the wind by highly localized scattering centers. The statistical mechanical theory corresponding to this model is traced in detail from Liouville's theorem through a kinetic equation to the conventional diffusion equation. The statistical nature of the fields within the magnetic irregularities is described in terms of an appropriate Fourier analysis. Author

N67-13132# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
THE PRIMARY COSMIC RAY ELECTRON SPECTRUM NEAR SOLAR MINIMUM
Jacques l'Heureux (Ph.D. Thesis) Nov. 1966 40 p refs Submitted for Publication
(Grants NsG-144-61; NSF GP-4709)
(NASA-CR-80481; EFINS-66-109) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Continuing investigations of the flux and energy spectrum of the primary cosmic ray electron component are reported. Balloon flight data are compared with the results obtained from observations of nonthermal radio emission from high galactic latitudes. The electron energy spectrum studied is for energies greater than 1 BeV, in agreement with the spectrum of galactic electrons derived from radio noise measurements. Below 1 BeV the measured electron energy spectrum is flatter than predicted for frequencies less than 50 Mc/sec (corresponding to electrons below 1 BeV). It is suggested that this might be an indication that solar modulation, even near solar minimum affects the electron spectrum measured at the earth. S.P.

N67-13162*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ADIABATIC MOTION OF ENERGETIC PARTICLES IN A MODEL MAGNETOSPHERE
Juan G. Roederer (NAS–NRC) Jul. 1966 65 p refs Presented at the Inter-Union Symp. on Solar Terrestrial Phys., Belgrade, 28 Aug.–2 Sep. 1966
(NASA-TM-X-55614; X-640-66-340) CFSTI: HC $3.00/MF $0.75 CSCL 04A

The motion of charged particles in a trapping field geometry is described by means of three adiabatic constants of motion. Numerical computations for particle shell geometry, time variations, drift velocities, bounce periods, and equatorial pitch angles are discussed. The conclusions reached from these calculations are presented, and the computer program listing is included. A.G.O.

N67-13163*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PROPOSAL FOR TRAPPED PARTICLE FLUX MAPPING IN THE OUTER MAGNETOSPHERE
Juan G. Roederer (NAS–NRC) Jun. 1966 35 p refs
(NASA-CR-55615; X-640-66-313) CFSTI: HC $2.00/MF $0.50 CSCL 04A

A computer code is described which can be used for a two-dimensional mapping of directional fluxes of energetic particles trapped in the outer magnetosphere. G. Mead's model of the magnetospheric field is used. The main function of the code is to find, on a fixed reference meridian, the field line, equatorial pitch angle and other parameters of the shell generated by the particles in their longitudinal drift, provided they are stably trapped. A series of curves is given, which can be used for a first rough, graphical attempt of flux mapping. The code is described in more detail in the appendix. Author

N67-13210*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
STATISTICAL EVALUATION OF PROTON RADIATION FROM SOLAR FLARES Final Technical Report

J. B. Weddell and J. W. Haffner 29 Jul. 1966 176 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951293)
(NASA-CR-80531; SID-66-421) CFSTI: HC $5.00/MF $1.00
CSCL 20H

The occurrence probability of solar high energy proton radiation has been evaluated statistically as a function of radiation flux, solar activity level, and solar distance. The results are applicable to determining the solar proton radiation environment of spacecraft in interplanetary space between 1 and 2 astronomical units (AU) in the 1969 to 1975 time period. To estimate the probability distribution of expected radiation levels, the sunspot number in these years was predicted by extrapolating the Fourier transformation of the sunspot numbers from 1748 to 1964. Theoretical analyses were used to evaluate the temporal variation of the solar proton flux versus energy as a function of solar distance, and the correlation coefficient of the annual proton flux versus energy with the sunspot numbers from 1956 to 1963 was calculated. A specific Mars mission was considered to illustrate the techniques used in the study, and recommendations of additional study areas are also presented. A.G.O.

N67-13238# Lockheed Missiles and Space Co., Palo Alto, Calif. Materials Sciences Lab.
ULTRAVIOLET RADIATION IN SPACE AND ITS INTERACTION WITH SPACECRAFT MATERIALS
R. E. Mauri [1966] 49 p refs

The effects of ultraviolet radiation on thermal control surfaces, structural plastics, elastomers, polymeric films and solar cell coverings, coatings, and adhesives are reviewed. Results of laboratory simulated exposures of materials to ultraviolet in vacuo indicated that the principal potential problem areas are associated with thermal control paints of the white-reflector type and polymeric thin films which undergo discoloration and reduction of significant mechanical properties. Other types of materials, used in bulk, are not as susceptible to damage of significant properties due to the limited penetration depth of ultraviolet radiation. Means for protection include the use of ultraviolet absorbers incorporated in the polymer matrix or the use of vacuum deposited interference or reflective type coatings over the surface exposed to sunlight. Inorganic base coatings incorporating high purity pigments appeared promising as thermal control materials from the ultraviolet stability standpoint. Author

N67-13244*# Chicago Univ., Ill. Lab. for Astrophysics and Space Research.
DIFFUSION AND CONVECTION OF ENERGETIC ELECTRONS BEHIND THE EARTH'S BOW SHOCK
J. R. Jokipii Oct. 1965 18 p refs Submitted for Publication
(Grant NsG-179-61)
(NASA-CR-68065; EFINS-65-93) CFSTI: HC $1.00/MF $0.50
CSCL 04A

Effects of diffusion on the energy spectrum of a group of electrons being convected downwind in the Earth's bow shock transition region are analyzed. The recent observation that the energy spectra of energetic electron pulses soften with increasing L_{SEP} is readily explained if each electron pulse is caused by a region of electrons being blown past the satellite. Electrons escape from the region by an energy dependent random walk through the irregular magnetic field. The observed change in the spectrum requires that the mean random walk step length λ be about 10^7 cm, or of the order of the cyclotron radius, for 40 keV electrons in the transition region. It is argued that this result is physically reasonable. Author

N67-13328# New York Univ., N. Y. Dept. of Physics.
THE MEASUREMENT OF ENVIRONMENTAL RADIATION
Annual Report, 1 Sep. 1965–31 Aug. 1966
1 Jul. 1966 60 p refs
(Contract AT(30-1)-1704)
(NYO-1704-13) CFSTI: HC $3.00/MF $0.75

Environmental studies are reported on: cosmic ray ionization in the first 10,000 ft, ultralow ionization intensities from terrestrial sources, and the beta component on the ground. New instruments for the cosmic ray laboratory are mentioned which include a large analytical balance, a large (130 liter) spherical monitoring chamber on the roof, special data recording equipment, provision for eventual data handling by computer, and new small spherical chambers. On field trips laboratory instrumentation was compared with the HASL scintillation spectrometer and ionization chamber. N5A

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N67-12474# Finnish Meteorological Office, Helsinki.
A GRAPHICAL METHOD FOR PREDICTING LOCALLY THE AZIMUTHAL COORDINATES OF AN ARTIFICIAL EARTH SATELLITE AT A GIVEN TIME AT A GIVEN OBSERVATION POINT ON THE EARTH'S SURFACE
Pentti Jaervi 1966 8 p *Its* Contrib. No. 60
CFSTI: HC $1.00/MF $0.50

General prediction data on the orbit of an artificial satellite from a calculation center are used to estimate azimuthal coordinates and azimuth and height angle of the observed satellite by utilizing a stereographic drawing board. Such predictions contain: (1) the geographical coordinates for the point where the segment of a straight line from the earth's centrum to the satellite intersects the earth's surface; and (2) the height of the satellite above the earth's surface in kilometers. The obtained curve, lying on the earth's surface and joining the above mentioned points, is the predicted track of the satellite. G.G.

N67-12661# Air Force Cambridge Research Labs., Bedford, Mass. Lunar-Planetary Research Branch.
THE COMPOSITION OF THE MARTIAN SURFACE
Roger A. Van Tassel and John W. Salisbury Apr. 1964 28 p refs
(AD-630076)

It is generally believed that the desert areas of Mars are composed of limonite. This belief, which is based upon polarimetric, spectrometric, color and albedo measurements, is in conflict with geologic reasoning. An examination of the evidence for limonite on Mars shows that the spectrometric measurements are most convincing. Laboratory experiments demonstrate, however, that the infrared emission spectra of minerals depend in part on grain size. Finely powdered minerals have infrared emission characteristic of a greybody, and yield very little spectral information. Thus, the Martian surface materials could be composed primarily of fine-grained silicates, or of coarse-grained silicates coated with finely divided limonite, without their presence being revealed spectrometrically. Author (TAB)

N67-12684# Tel-Aviv Univ. (Israel). Inst. of Planetary and Space Science.
SATSHEVA SEMINAR ON PLANETARY PHYSICS 1966
Final Report, Aug. 1–Sep. 9, 1966
Uri Shafrir 13 Sep. 1966 69 p refs
CFSTI: HC $3.00/MF $0.75

CONTENTS:

1. TWO FREQUENCY BEAT OCCULTATION EXPERIMENT FOR A MARS ORBITER Z. Houminer (Natl. Committee for Space Res.) p 11–26 refs (See N67-12665 03-30)

2. MEASUREMENTS OF SURFACE AND ATMOSPHERIC PARAMETERS BY POLARIZATION EXPERIMENTS FROM A MARTIAN ORBITER A. Yaniv and N. Levanon p 27–39 refs (See N67-12666 03-30)

3. MEASUREMENTS OF SURFACE AND ATMOSPHERIC PARAMETERS BY GAMMA-SPECTROSCOPY FROM A MARTIAN ORBITER G. Asaf and S. T. Kruger p 40–45 refs (See N67-12667 03-30)

4. THE MEASUREMENT OF WATER VAPOR ON MARS BY 6.3μ ABSORPTION EXPERIMENT FROM AN ORBITER Y. Ben-Aryeh p 46–49 refs (See N67-12668 03-30)

5. PANEL DISCUSSION: "WHAT SHOULD BE THE PART OF ISRAEL IN SPACE-RELATED ACTIVITIES"? p 50–61

N67-12665# National Committee for Space Research, Tel Aviv (Israel).

TWO FREQUENCY BEAT OCCULTATION EXPERIMENT FOR A MARS ORBITER

Zwi Houminer *In its* Batsheva Seminar on Planetary Phys. 1966 13 Sep. 1966 p 11–26 refs (See N67-12664 03-30) CFSTI: HC $3.00/MF $0.75

A two frequency beat occultation experimental procedure for studying planetary atmospheres is described. The techniques can be used by a Mars orbiter. When an orbiter passes behind the planet as viewed from the earth, the radio ray path from transmitter to receiver passes tangentially through the ionosphere and atmosphere and is occulted at the limb. The presence of an atmosphere and ionosphere causes the velocity of propagation of the radio signal to deviate from that in free space, because of the non-unity refractive index of the neutral and ionized media. Calculations for the electron density of the ionosphere, and for the refractivity profile of the neutral atmosphere, are presented. Data results from the Mariner IV occultation experiment are given, and are discussed. It is concluded that the two frequency beat occultation method is a good technique for studying planetary atmospheres because it is simple to perform and does not add much to the orbiter weight. In addition, the method permits diurnal and seasonal changes in different regions of the atmosphere to be studied from a single orbiting satellite. L.S.

N67-12666# Tel-Aviv Univ. (Israel). Inst. of Planetary and Space Science.

MEASUREMENT OF SURFACE AND ATMOSPHERIC PARAMETERS BY POLARIZATION EXPERIMENTS FROM A MARTIAN ORBITER

Akiva Yaniv and Nadav Levanon *In its* Batsheva Seminar on Planetary Phys. 1966 13 Sep. 1966 p 27–39 refs (See N67-12664 03-30) CFSTI: HC $3.00/MF $0.75

A means of measuring Martian surface and atmospheric parameters (chemical and physical surface structure, cloudiness and turbidity of the atmosphere, pressure profile of atmospheric density, ice cap composition, and ice cap geometry as a function of season) by light polarization experiments using instrumentation aboard a Martian orbiter space probe, is described. The polarization phenomenon, the instrumentation, and the geometry of the proposed experiment are also described. Tables of polarization data for basalt, granite, quartz sandstone, red sandstone, and water droplets are given. The data indicate how material type, size, roughness, or smoothness, or water vapor affect changes in the polarization readings. L.S.

N67-12667# Weizmann Inst. of Science, Rehovoth (Israel).

MEASUREMENTS OF SURFACE AND ATMOSPHERIC PARAMETERS BY GAMMA-SPECTROSCOPY FROM A MARTIAN ORBITER

Gad Asaf and Steve T. Kruger *In* Tel-Aviv Univ. Batsheva Seminar on Planetary Phys. 1966 13 Sep. 1966 p 40–45 refs (See N67-12664 03-30) CFSTI: HC $3.00/MF $0.75

A proposed method of measuring the surface and atmospheric parameters of Mars by means of a gamma ray spectrometer aboard the Voyager orbital mission is discussed. Possible information on the composition and past history of Mars which might be obtained through measurements of the gamma rays emerging from the Martian surface and atmosphere are examined in a general way. Natural radioactivity sources K^{40}, Th^{232}, and U^{235}, and cosmic ray induced radioactivity are discussed. A CsI(Tl) crystal instrumentation system is described; and tables of data regarding radionuclides are given. L.S.

N67-12668# Israel Inst. of Tech., Haifa. Dept. of Physics.

THE MEASUREMENT OF WATER VAPOR ON MARS BY 6.3μ ABSORPTION EXPERIMENT FROM AN ORBITER

Yacob Ben-Aryeh *In* Tel-Aviv Univ. Batsheva Seminar on Planetary Phys. 1966 13 Sep. 1966 p 46–49 refs (See N67-12664 03-30) CFSTI: HC $3.00/MF $0.75

An absorption spectroscopic method of quantitatively determining the abundance of water vapor in the atmosphere of Mars from instrumentation aboard an orbiter is suggested. A band model theory for determining the atmospheric transmission function is described; and a geometric diagram of the suggested experiment is depicted. The use of infrared radiometric instruments aboard planetary space probes to measure radiation from the sun is also discussed. L.S.

N67-12694# European Space Vehicle Launcher Development Organization, Paris (France).

SPACE MISSIONS [LES MISSIONS SPATIALES]

M. Gilli Sep. 1966 26 p In FRENCH

(ELDO-TM-F-27) CFSTI: HC $2.00/MF $0.50

The chief mission characteristics of the ELDO space vehicle launcher program are detailed. According to category and degree of difficulty, the mission objectives include Earth-orbital flights, space sounding, and manned flights. Applications of Earth-orbital missions are for the fields of meteorology, geodesy, navigation, telecommunications, and television. Space sounding missions, on geocentric or heliocentric orbits, are to study interplanetary space, and the solar system, including comets and asteroids. Manned flights envisage lunar, planetary, and Earth-orbits. The space vehicle launcher planned is to be of the Saturn V type. Tabular data on projected missions give details on velocity, orbital altitude and inclination, weight, electric power, and cost, by the type and name of launcher. Transl. by R.Ll.

N67-12719*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ON THE WAY TO THE MOON

Bruce T. Lundin Washington, NASA, 1966 47 p Presented at the Jennings Scholar Lecture held at Lewis Res. Center, 22 Oct. 1966

(NASA-TM-X-52255) CFSTI: HC $2.00/MF $0.50 CSCL 22A

Activities related to lunar and planetary exploration are discussed in terms of the impact such research has had on the teaching of science. It is emphasized that the new knowledge obtained during both manned and unmanned space flights cut across practically all fields of science; and the move toward a broader spirit of inquiry into the physical surroundings of man is considered one of the important accompaniments of space research. Recent space activities are summarized; and while most of the public's attention has been directed to docking, rendezvous, and design and operation of the spacecraft, it is noted that these activities have accomplished much toward defining the physiological costs and operational requirements to support men during prolonged space flights. The global extent involved in the organization of human

effort behind the flight of a Mariner or any other spacecraft is stressed; and various means of communicating and obtaining data from spacecraft are discussed. Applications of space research to meteorology and other technical fields are considered. M.W.R.

N67-12727# Indian Statistical Inst., Calcutta.
PASTEUR AND COSMIC ASYMMETRY
J. B. S. Haldane *In* NAS-NRC Extraterrest. Life 1966 p 81 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Mention is made of Louis Pasteur's belief in the asymmetry of the universe, an idea which has since been substantiated by Yang and Lee's discovery of the non-conservation of parity in certain interactions of fundamental particles. M.W.R.

N67-12731# Academy of Sciences (USSR), Leningrad. Pulkovo Observatory.
PHYSICAL OBSERVATIONS OF THE LUNAR SURFACE
N. A. Kozyrev *In* NAS-NRC Extraterrest. Life 1966 p 102–123 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Observations by Dinsmore Alter of the lunar haze which temporarily obscures details of the lunar craters are discussed, as are spectral observations of Alphonsus made on November 3, 1958. Spectrograms of the latter are included; and on one it is noted that the ordinary spectrum of the central peak has been covered by an additional emission whose most distinctive feature is a group of bands with a comparatively sharp red edge at about 4740Å. This is typical of the spectra of cometary heads, and is basically a band in the Swan resonance series of the diatomic molecules of carbon. Spectral observations of Alphonsus on October 23, 1959, indicate that an active volcanic process at least equal to the large terrestrial eruptions took place. The axial ridge of the Alphonsus crater is considered to be in the stage of formation. It is conjectured that the central peaks of lunar craters have the same origin as terrestrial ones; and the craters themselves bear a similarity to the calderas of terrestrial volcanoes. The fact that the lunar craters are larger than terrestrial ones is related to the small gravity of the moon as compared to that of earth. M.W.R.

N67-12745# California Inst. of Tech., Pasadena.
MARINER IV PHOTOGRAPHY OF MARS: INITIAL RESULTS
Robert B. Leighton, Bruce C. Murray, Robert P. Sharp, J. Denton Allen, and Richard K. Sloan *In* NAS-NRC Extraterrest. Life 1966 p 307–312 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Crater size distribution and identification of other features from Mariner IV photography are discussed. To take care of the wide illumination range and low surface contrast that was expected, a slow-scan vidicon capable of handling a 30-to-1 illumination range with fixed voltages was used. A digital transmission system took care of the low communication rate from the planet. It is noted that the principal topographic features on Mars were not produced by stress and deformation originating within the planet as is the case for the earth. Mars is considered to have been inactive for a long time, an observation which is consistent with the lack of a significant magnetic field on Mars as determined by the Mariner magnetometer experiments. Neither possible existence nor preclusion of life on Mars is evidenced by these photographs, but the search for a fossil record appears less promising if Martian oceans never existed. On the other hand, the Martian surface may contain evidence of primitive organic development which has long since disappeared from earth. M.W.R.

N67-12747# Oliver Machinery Co., Grand Rapids, Mich.
MARS: AN ESTIMATE OF THE AGE OF ITS SURFACE
Ralph B. Baldwin *In* NAS-NRC Extraterrest. Life 1966 p 318–321 refs Reprinted Revised (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

The age of the Martian surface as seen by Mariner IV is calculated to be between 340 and 680 million years on the basis of comparisons of Martian and lunar craters. In the small area of Mars photographed, crater size varies from 3 to 120 km in diameter. It appears highly probable that the surface of Mars photographed by Mariner IV is quite young from a geological point of view. If the present influx of large infalls on Mars is as low as the observed micrometeorite flux near the planet, the age of the Martian surface is estimated to be 6.8×10^8 years. M.W.R.

N67-12748# IIT Research Inst., Chicago, Ill.
MARS: AGE OF ITS CRATERS
J. Witting, F. Narin, and C. A. Stone *In* NAS-NRC Extraterrest. Life 1966 p 322–326 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Average age of the Martian craters is considered to be less than 300 million years if the craters on Mars were formed by asteroidal particles with spatial distributions independent of asteroid size, and if both spatial distributions and total numbers are independent of time. Aside from difficulties in extrapolating asteroidal data to lunar distances, which can lead to errors; the case for concluding that the Martian craters are relatively young is based on these three assumptions: (1) Collision with asteroidal bodies is the primary process leading to craters of 4 to 120 km in diameter on the Moon and Mars. (2) Spatial distribution and numbers of asteroids have been fairly constant over time compared to the lifetime of a lunar crater. (3) Spatial distribution of asteroids is the same for crater-makers as for larger catalogued asteroids, although the total numbers may differ. It is noted that the validity of these assumptions, especially the second, is unlikely to be checked in the near future; and, therefore, the present age calculation should be regarded as an alternative to earlier suggestions rather than a definitive prediction. M.W.R.

N67-12749# Rice Univ., Houston, Tex.
MARINER IV MEASUREMENTS NEAR MARS–INITIAL RESULTS: SPACECRAFT DESCRIPTION AND ENCOUNTER SEQUENCE
Hugh R. Anderson *In* NAS-NRC Extraterrest. Life 1966 p 327–331 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Capabilities and performance of the Mariner IV spacecraft are considered, and the areocentric equatorial coordinates of Mariner IV are tabulated for the various observation positions. These positions include incoming asymptote, cross equatorial plane, cross noon meridian, closest approach, enter and exit occultations, and outgoing asymptote. The encounter sequence and trajectory is also shown. M.W.R.

N67-12750# State Univ. of Iowa, Iowa City.
MARINER IV MEASUREMENTS NEAR MARS–INITIAL RESULTS: ABSENCE OF MARTIAL RADIATION BELTS AND IMPLICATIONS THEREOF
James A. Van Allen, L. A. Frank, S. M. Krimigis, and H. K. Hills *In* NAS-NRC Extraterrest. Life 1966 p 332–341 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00
(Grant NsG-233-62)

A system of sensitive particle detectors on Mariner IV showed the presence of electrons of energy E_e 40 keV out to a radial distance of 165,000 km in the morning fringe of the earth's magnetosphere, but failed to detect any such electrons whatever during the close encounter with Mars on July 14–15, 1965, for which the minimum areocentric radial distance was 13,200 km. This result is interpreted to mean that the ratio of the magnetic

dipole moment of Mars to that of the earth M_M/M_E is surely less than 0.001, and probably less than 0.0005. The corresponding upper limits on the equatorial magnetic field at the surface of Mars are 200 and 100 gammas, respectively. It appears possible that the solar wind interacts directly with the Martian atmosphere.
Author

N67-12751# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
MARINER IV MEASUREMENTS NEAR MARS--INITIAL RESULTS: SEARCH FOR TRAPPED ELECTRONS AND A MAGNETIC MOMENT AT MARS BY MARINER IV
J. J. O'Gallagher and John A. Simpson *In* NAS-NRC Extraterrest. Life 1966 p 342-354 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00
(Grant NsG-179-61; Contract JPL-950615; Grant AF-AFOSR-521-65)

The Mariner IV spacecraft on 14-15 July 1965 passed within 9850 kilometers of Mars, carrying a solid-state charged-particle telescope which could detect electrons greater than 40 kiloelectron volts and protons greater than 1 million electron volts. The trajectory could have passed through a bow shock, a transition region, and a magnetospheric boundary where particles could be stably trapped for a wide range of Martian magnetic moments. No evidence of charged-particle radiation was found in any of these regions. In view of these results, an upper limit is established for the Martian magnetic moment provided it is assumed that the same physical processes leading to acceleration and trapping of electrons in earth's magnetic field would be found in a Martian magnetic field. On this basis, the upper limit for the Martian magnetic moment is 0.1% that of earth for a wide range of postulated orientations with respect to the rotational axis of Mars. The implications of these results for the physical and biological environment of Mars are briefly discussed.
Author

N67-12752# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARINER IV MEASUREMENTS NEAR MARS--INITIAL RESULTS: ZODIACAL DUST: MEASUREMENTS BY MARINER IV
W. M. Alexander, Curtis W. Mc Cracken, and J. L. Bohn (Temple Univ.) *In* NAS-NRC Extraterrest. Life 1966 p 355-357 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Data from the Mariner IV dust-particle experiment reveal an increase by a factor of 5 in the flux of interplanetary dust particles as the heliocentric distance from the sun increases. There is a variation in the slope of the cumulative flux-mass distribution, with the steepest slope for the distribution occurring between the planets. No enhancement of the flux in the vicinity of Mars was detected.
Author

N67-12753# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER IV MEASUREMENTS NEAR MARS--INITIAL RESULTS: MAGNETIC FIELD MEASUREMENTS NEAR MARS
Edward J. Smith, Leverett Davis, Jr., Paul J. Coleman (Calif. Univ., Los Angeles), and Douglas E. Jones (Brigham Young Univ.) *In* NAS-NRC Extraterrest. Life 1966 p 358-361 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00
(Contract NASw-7; Grants NsG-426; NGR-05-007-065; NGR-45-001-011)

During the encounter between Mariner IV and Mars, no magnetic effect that could be definitely associated with the planet was evident in the magnetometer data. This observation implies that the Martian magnetic dipole moment is, at most, 3×10^{-4} times that of the earth.
Author

N67-12754# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER IV MEASUREMENTS NEAR MARS--INITIAL RESULTS: OCCULTATION EXPERIMENT: RESULTS OF THE FIRST DIRECT MEASUREMENT OF MAR'S ATMOSPHERE AND IONOSPHERE
Arvydas Kliore, Dan L. Cain, Gerald S. Levy, Von R. Eshleman, Gunnar Fjeldbo (Stanford Univ.) et al *In* NAS-NRC Extraterrest. Life 1966 p 362-373 refs Reprinted Prepared jointly with Stanford Univ. (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00
(Contract NAS7-100; Grants NGR-05-020-065; NsG-377)

Changes in the frequency, phase, and amplitude of the Mariner IV radio signal, caused by passage through the atmosphere and ionosphere of Mars, were observed immediately before and after occultation by the planet. Preliminary analysis of these effects has yielded estimates of the refractivity and density of the atmosphere near the surface, the scale height in the atmosphere, and the electron density profile of the Martian ionosphere. The atmospheric density, temperature, and scale height are lower than previously predicted, as are the maximum density, temperature, scale height, and altitude of the ionosphere.
Author

N67-12755 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET REFLECTIVITY OF MARS
Dennis C. Evans *In* NAS-NRC Extraterrest. Life 1966 p 374-381 refs Reprinted (See N67-12721 03-04) Available from NAS-NRC, Washington, D. C.: $6.00

Ultraviolet spectrograms of Mars (2400 to 3500 angstroms, ~50-Å resolution) have been obtained with an objective grating spectrograph on an Aerobee rocket. The data indicate a reflectivity of 0.04 to 0.08 in the ultraviolet, increasing toward shorter wavelength according to a Rayleigh Law. The data can be represented by a model having an atmosphere of nitrogen, carbon dioxide, and argon; and a surface pressure of about 5 to 20 millibars. The photographic appearance of the planet in the blue is interpreted as a loss of surface contrast and reflectivity rather than an absorption in the atmosphere by the "blue haze." The model permits prediction of the general appearance of the planet in the photographic ultraviolet, blue, visible, and red. There are serious biological implications since the model suggests that ultraviolet radiation (2000 to 3000 Å) will reach the surface.
Author

N67-12787*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JUPITER HIGH-THRUST ROUND-TRIP TRAJECTORIES
Roger W. Luidens, Brent A. Miller, and Jay M. Kappraff Washington, NASA, Dec. 1966 39 p refs
(NASA-TN-D-3739) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The propulsion requirements are analyzed for round trips to Jupiter using the following four concepts: (1) optimize the heliocentric transfer angles, (2) use low periapsis elliptical parking orbits at Jupiter, (3) use atmosphere braking at Earth return, and (4) use hyperbolic rendezvous at Jupiter. Total trip times of 500 to 2200 days and stay times of 0 to 200 days were considered. The present study also considers several types of maneuvers for entering and leaving an elliptical parking orbit, a range of elliptical parking orbit apoapses, trajectories lying out of the plane of the ecliptic, and symmetrical (transit times and angles the same for the outbound and the inbound legs) and unsymmetrical trips. The analysis assumes successive two-body trajectories, impulsive thrusting, and circular coplanar planetary orbits. The criterion for comparing the various trajectories is the required total propulsive velocity increment.
Author

N67-12817*# National Aeronautics and Space Administration, Washington, D. C.
STEPS INTO THE UNIVERSE (FROM THE LOGBOOK OF THE VOSKHOD-2) [SHAGI VO VESELENNOY (POSTRANIT-SAM BORITZHURNALVOSKHODA-2)]
Nov. 1966 17 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 5, 1966 p 27–31
(NASA-TT-F-10604) CFSTI: HC $1.00/MF $0.50 CSCL 22A

A journalistic account of the Voskhod 2 flight is presented. Excerpts from the logbook are given, and the tests, preparation for the space walk, and the walk are described briefly. Emphasis is placed on the impressions of the astronaut. N.E.N.

N67-12864# Los Alamos Scientific Lab., N. Mex.
CONTRIBUTIONS TO THE FEASIBILITY STUDY OF AN EARLY LUNAR FLARE
R. A. Jeffries and Jerry Wackerle 25 Jul. 1966 81 p refs
(Contract W-7405-ENG-36)
(LA-3453) CFSTI: HC $3.00/MF $0.75

A limited investigation of certain aspects of the feasibility of the ELF concept, a proposal for obtaining chemical and physical information about the lunar surface, is described. This information will be gathered by the earth-based observation of the impact of a highly reactive chemical flare upon the moon. Results are given of shock-wave compression measurements of the liquid chlorine trifluoride–aluminum mixture currently favored as the flare material. Also reported are experiments which demonstrated that modest amounts of this mixture do not sustain high-order detonation under strong shock loading. Finally, experiments are described which were designed to simulate, in reduced scale, the anticipated impact event. While some observations of the latter experiments did, on cursory study, appear detrimental to the feasibility of the ELF proposal, on more careful examination these results were invariably caused by experimental limitations and were not due to any inherent weaknesses in the concept. Suggestions are made for future investigations leading to a more thorough understanding of an impact event. Author (NSA)

N67-12905*# Volt Technical Corp., Washington, D. C.
COMPARISON OF THE REFLECTION CHARACTERISTICS OF MARS IN THE 40 AND 12.5 CM WAVELENGTHS ACCORDING TO RADAR OBSERVATIONS DURING THE OPPOSITION IN 1963
Yu. N. Aleksandrov and O. N. Rzhiga 30 Sep. 1966 6 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 43, no. 4, 1966 p 813–816
(Contract NAS5-12487)
(NASA-CR-80145; ST-LPS-RA-10520) CFSTI: HC $1.00/MF $0.50 CSCL 03B

As was shown by radar observations of Mars in decimeter waves, the basic reflection back to locator is given by the regions near the center of the planetary disk. This allows us to compare the reflectivity of separate regions of the surface of Mars. It is found that the dependences of reflectivity on the longitude of the central meridian at wavelengths of 40 to 12.5 cm are correlated. The value of the correlation factor for the data obtained in these wavelengths in 1963 is +0.46. The mean reflection factor of the Martian surface at wavelengths longer than 40 cm is about 0.07, which corresponds to the mean value of the dielectric constant 3.0. The radar observation data failed to provide any indication on the presence of water on the surface of Mars. Author

N67-12910*# Consultants and Designers, Inc., Arlington, Va.
ON THE MECHANISM BEHIND THE FRAGMENTATION OF TINY METEOR BODIES IN THE ATMOSPHERE
V. N. Lebedinets and Yu. I. Portnyagin 7 Jul. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Astron. (USSR), v. 168, no. 3, 1966 p 543–546
(Contract NAS5-9299)
(NASA-CR-80159; ST-IM-10502) CFSTI: HC $1.00/MF $0.50 CSCL 03B

It is shown in this work that the various peculiarities of tiny meteors, revealed by photographic observations and usually explained by the very loose and friable structure of their bodies, can in reality be explained without resorting to that hypothesis. Author

N67-12944# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOME PROPERTIES OF A TWO-COMPONENT SOLAR CORRECTION
A. K. Platonov and Iu. D. Teterin [1966] 7 p refs Transl. into ENGLISH of a Russian Rept. Presented at IAF Meeting, Madrid, 1966

Equations are presented for a two-time solar correction case of spacecraft trajectories, when the correcting impulse belongs to some plane oriented in a known manner of space. Properties of a two-component correction are investigated, and the relationships are given for computing the minimum impulse at fixed times. Utilization of the Bellman principle permitted determination of the optimum three-time correction moments and directions in a plane perpendicular to the direction of the sun by numerical means. S.P.

N67-12964*# Lockheed Missiles and Space Co., Palo Alto, Calif.
FEASIBILITY STUDY OF SEVERAL X-RAY EXPERIMENTS FOR AN ORBITING ASTRONOMICAL OBSERVATORY
Final Report
Philip C. Fisher 17 Aug. 1966 80 p refs
(Contracts NASw-917; NASw-909)
(NASA-CR-80344, LMSC-M-27-66-1) CFSTI: HC $3.00/MF $0.75 CSCL 22A

Satellite-experiment design information derived from laboratory studies and flight experiments is presented. Discussed are: (1) an X-ray optical collection device of the Venetian-blind type in which the highest possible collection efficiency was to be combined with a modest angular resolution; and (2) high-sensitivity detectors for the simultaneous high-efficiency, low-noise detection and amplification of information contained by a large quantity of soft X-rays. These two types of apparatus were combined with a novel arrangement for dispersion of different energy X-rays, the entire arrangement thus forming a spectrograph of about one percent energy resolution continuously sensitive to all wavelengths throughout the 0.3 to 3 keV energy range. An evaluation of the theoretical aspects, prototype and test unit performance, and problems that remain to be solved is given. K.W.

N67-12981*# California Univ., Los Angeles.
GRAVITATIONAL EQUILIBRIA OF A RIGID BODY CONTAINING SYMMETRIC ROTORS
Robert E. Roberson and William W. Hooker [1966] 14 p refs Presented at the Intern. Astronautical Congr., Madrid, Oct. 1966 Submitted for Publication
(Grant NGR-05-007-099)
(NASA-CR-80354) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The classical problem of the existence and stability of equilibrium orientations of an aspherical body in a nonuniform graviational field has various generalizations which have direct applications to modern astronautical problems. One of these generalizations is treated: the problem of a single rigid body containing a symmetric constant speed fixed axis rotor, i.e., a gyrostat. Consideration is given to the existence and determination of gravitational equilibria for three basic cases for gyrostats on circular orbits in an inverse square field. Author

N67-12982*# California Univ., Berkeley. Space Sciences Lab.
REFLECTION SPECTRA AS A BASIS FOR STUDYING EXTRATERRESTRIAL LIFE Semiannual Report, May 1–Oct. 31, 1966
Melvin Calvin and Harold F. Weaver 30 Sep. 1966 13 p refs *Its* Ser. no. 7, Issue No. 54
(Grant NsG-101-61)
(NASA-CR-80353) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Efforts during this period on planetary spectroscopy included calculations of the effect of re-radiation in lunar craters on apparent brightness temperatures, the search for a halo effect on Venus, the construction of a photometer-polarimeter for laboratory reflection studies of powdered samples, the design and construction of a high vacuum system for studying the interaction of mineral powders with an H_2O and CO_2 atmosphere in the presence of ultraviolet radiation, and a re-examination of the polarimetric evidence for an atmosphere on Mercury. Also discussed is work on the development of mass spectrometric and analytic techniques, and the analysis of organic matter in ancient sediments and meteorites. R.N.A.

N67-13004*# Colorado Univ., Boulder.
GEOMETRIC CONSTRAINTS OF THE DISORBIT PROBLEM
Adolf Busemann, Nguyen X. Vinh, and Robert D. Culp 8 Jul. 1966 9 p refs Presented at the Space Flight Mech. Specialist Conf., Denver Univ., Colo., 6–8 Jul. 1966 *Its* Preprint 66-122
(Grant NGR-06-003-033)
(NASA-CR-80369) CFSTI: HC $1.00/MF $0.50 CSCL 22C

An approach to orbital change problems is described, using a configuration space in which orbital problems remain problems of conics, combined with the geometrical properties inherent to Keplerian orbits. The case considered is the general one of descent from an elliptical orbit, under the restriction that all motion is confined to a plane through the center of the attracting planet. The disorbit was assumed to be achieved by a single impulsive change of velocity. The disorbit maneuver is subjected to various constraints, and the resulting geometrical constraints are discussed. M.G.J.

N67-13013*# Consultants and Designers, Inc., Arlington, Va.
MAJOR LANDMARK IN THE INVESTIGATION OF OUTER SPACE
A. P. Vinogradov, N. L. Grigorov, and A. A. Mikhaylov 21 Apr. 1966 12 p Transl. into ENGLISH from Russian
(Contract NAS5-9299)
(NASA-CR-80160; ST-PR-LPS-10479) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Highlights of the press conference on the Lunik X are reported, along with the more pertinent questions asked the scientists by Soviet and foreign newsmen. The geochemical aspects of the data obtained by Lunik X is assessed; preliminary estimates indicate that the natural radioactive elements in lunar rocks lie within the range of the earth's basaltic rocks. A tentative conclusion is drawn that the crust formation processes for the planets of the earth's group have the same mechanism. The measurements made of the magnetic field, the ionosphere, and radiation are described; it was found that the magnetic field intensity, the concentration of positive ions, and the radiation intensity are dependent on the position of the moon relative to the sun–earth line. M.G.J.

N67-13018*# GCA Technology Div., GCA Corp., Bedford, Mass.
TEMPERATURE DETERMINATION OF PLANETARY ATMOSPHERES. OPTIMUM BOUNDARY CONDITIONS FOR BOTH LOW AND HIGH SOLAR ACTIVITY
R. A. Minzner and G. O. Sauermann Feb. 1966 55 p refs
(Contract NASw-1225)
(NASA-CR-79525; GCA-TR-66-6-N) CFSTI: HC $3.00/MF $0.50 CSCL 03B

One-gas and two-gas methods are proposed for obtaining accurate temperature–altitude profiles. Using atmospheric models for both high and low solar activity, analytical and numerical examinations of the single gas and double gas equations for both high and low altitude reference levels indicate the conditions which optimize each type of calculation. The method depends upon the use of airborne mass spectrometers with detection sensitivities on the order of 10^4 to 10^5 particles per cubic centimeter. To verify the relative suitability of the several approaches, a rigorous error analysis based on the Gaussian method was performed for each case considered. The results show: (1) For optimum conditions, the high altitude reference level should be chosen as the altitude for which the uncertainty in observed number–density data is 100%. (2) Absolute temperature uncertainty is not strongly influenced by variations in number–density models associated with variations in solar activity. (3) The percentage uncertainty at high altitudes, however, is strongly influenced by such variations in number–density models. M.G.J.

N67-13023*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MARS SURFACE FORMATION, SURFACE MATERIALS, AND TERRAIN
Herbert H. Hoop Redstone Arsenal, Ala., Redstone Sci. Inform. Center, 30 Sep. 1966 104 p refs
(NASA-TM-X-59177; RSIC-592) CFSTI: HC $4.00/MF $0.75 CSCL 03B

This summary and annotated bibliography is a selection of the more accepted literature from the enormous quantity which covers the range of hypotheses as to Mars surface formation, surface material, and terrain. Various hypotheses and the few generally accepted facts are discussed. Included is a selected bibliography, author index, and subject index. Author

N67-13051# European Space Research Organization, Paris (France).
OBSERVATION OF STELLAR X-RAY SOURCES
B. Rossi (Mass. Inst. of Tech.) May 1966 66 p refs Lecture given at ESRO Summer School, Alpbach, Austria, 4 Aug. 1965
(ESRO-SM-59) CFSTI: HC $2.50/MF $0.75

The limitations of X-ray astronomy due to absorption and production of secondary photons in the atmosphere are discussed. Almost all measurements have to be conducted from rockets or satellites. The experiments which have been carried out so far are mentioned. In the second chapter the detectors employed (gas counters, scintillation crystals and photoelectric devices) are described as well as ancillary instrumentation. The analysis of data obtained from rocket flights is extensively discussed. In the last chapter the results of the observations performed until now are presented and compared in detail. The present knowledge on extraterrestrial nonsolar X-ray sources is critically reviewed. Author (ESRO)

N67-13052# Sterrewacht Sonnenborgh, Utrecht (Netherlands).
THE PREDICTED LINE BLOCKING IN THE SPECTRAL REGION 1900 Å TO 3000 Å OF A B STAR
Eric W. Elst [1966] 17 p refs Submitted for Publication
CFSTI: HC $1.00/MF $0.50

The line blocking in the spectral region 1900 Å to 3000 Å has been investigated for a line-blanketed model atmosphere which represents stars of about spectral type B 1.5V. The equivalent widths of some representative lines have been calculated and an estimate of the line blocking due to each ionic spectrum in each interval of 100 Å is made. The total depression due to line blocking per 100 Å interval, Δm, is displayed as a function of wavelength. A significant line blocking occurs at wavelengths shorter than 2200 Å. The most important spectra for causing line blocking appear to be Cr III, Fe II and Fe III. Author (ESRO)

N67-13095# National Academy of Sciences-National Research Council, Washington, D. C.
SPACE RESEARCH–DIRECTIONS FOR THE FUTURE
1966 650 p refs
(Publ.-1403) Available from NAS–NRC, Washington, D. C.: $7.50

A multidisciplinary study was conducted to develop a program of planetary exploration and to recommend priority within it, to determine the needs of astronomy in space, and to consider the role of man in space research. The findings and recommendations presented cover planetary and lunar exploration, the four branches of astronomy and some special topics in physics and geophysics, rocket and satellite research, university programs, biology, medicine and physiology, and man's role in space research. R.N.A.

N67-13112*# Missouri Univ., Rolla. Graduate School.
THEORY OF THE LUNAR PHOTOELECTRON ATMOSPHERE
Hal Emerson Mc Cloud, Jr. (Ph.D. Thesis) Aug. 1966 86 p refs
(Grant NGR-26-004-014)
(NASA-CR-80428) CFSTI: HC $3.00/MF $0.75 CSCL 03B

By considering the mechanics of an electron projected into an arbitrary potential field together with Poisson's equation it is possible to set up a differential equation for the electrostatic potential. The equation may be integrated and the photoelectron density found as a function of height for four approximate models. A simple model based upon monoenergetic photons and monoenergetic electrons ejected vertically upward yields rough estimates of the parameters of interest. Another model takes into account the fact that the photoelectrons are ejected at all angles. A general model takes into account the illumination of the lunar surface by solar radiation and also the distribution in energy of the electrons ejected for each photon energy. An adiabatic gas model of the photoelectron atmosphere provides an independent check of the results. Assuming a metalic surface the electron density is of the order of 10^4 electrons/cm^3 at a half-height of the order of 1.5 cm above the lunar surface. Author

N67-13135# Cincinnati Univ., Ohio.
ELEMENTS OF A THEORY OF LIBRATIONAL MOTIONS IN THE ELLIPTICAL RESTRICTED PROBLEM
E. Rabe [1963] 20 p ref

The nonperiodic motion of any small mass is considered with respect to the theory of librational motions. The two finite masses involved are called Sun and Jupiter, and the body of negligibly small mass a Trojan planet. However, the derivations are valid for the elliptical Earth–Moon problem (in the absence of the Sun), or for any mass ratio permitting the existence of periodic solutions in the restricted case of the problem. First the periodic orbits of the restricted problem are transposed into an elliptical system by applying the periodic scale factor as determined by Jupiter's elliptic motion. Then the differential equations are established for the deviation of the true motion from this pulsating or modified intermediate orbit. S.P.

N67-13157# National Bureau of Standards, Washington, D. C.
THE SPHEROIDAL METHOD IN THE THEORY OF ARTIFICIAL SATELLITE MOTION
J. P. Vinti [1966] 10 p

A zero-order potential, which leads to a Hamilton–Jacobi equation, was selected for application to satellite motion because of the oblate shape of the earth and because the Hamilton–Jacobi equation is separable in oblate-spheroidal coordinates. Consideration is given to its connection with problem of two fixed centers, accuracy of the Vinti potential, and effects of aspherical deviations. L.E.W.

N67-13177*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PAYLOAD CAPABILITIES OF SATURN IB-CENTAUR FOR LAUNCH OPPORTUNITIES TO MARS IN 1971, 1973, AND 1975 AND TO VENUS IN 1972 AND 1973
Gary D. Sagerman and Tim J. Kreiter Washington, NASA, Dec. 1966 30 p refs
(NASA-TM-X-1327) CFSTI: HC $2.00/MF $0.50 CSCL 22A

A study was made to determine energy requirements for interplanetary missions to Mars and Venus. Corresponding payloads using the Saturn IB-Centaur launch vehicle were also determined. The 1971, 1973, and 1975 Mars launch opportunities and the 1972 and 1973 Venus launch opportunities were investigated. Three mission profiles were considered: a flyby, an orbiter, and a combined orbiter-lander. A retrostage using Earth-storable propellants was provided for the orbiter and orbiter-lander missions, which require retropropulsion near the target planet. Data presented for flyby missions are also applicable for a direct lander mission which uses only atmospheric braking. Both type I trajectories (heliocentric travel angle less than 180°) and type II trajectories (heliocentric travel angle greater than 180°) were studied. Considering only type I trajectories over a 30-day interval in each opportunity, payloads for the Mars flyby mission were 11,400 pounds in 1971, 10,060 pounds in 1973, and 8,920 pounds in 1975. The maximum communication distances required were 1.3 astronomical units in 1971, 1.34 astronomical units in 1973, and 1.69 astronomical units in 1975. Maximum flight times were 220 days in 1971, 196 days in 1973, and 209 days in 1975. Similar data are presented for type I and type II trajectories for all three mission profiles to Mars and Venus. Author

N67-13183*# Bendix Corp., South Bend, Ind. Analytical Mechanics Dept.
SURVEYOR LUNAR TOUCHDOWN STABILITY STUDY Final Report, Jul. 1965–Jul. 1966
R. G. Alderson and D. A. Wells 8 Jul. 1966 230 p refs Prepared for JPL
(Contract NAS7-100; JPL-951304)
(NASA-CR-80514; MM-66-19) CFSTI: HC $3.75/MF $1.25 CSCL 22A

This summary of the Surveyor lunar touchdown stability study contains an analytical dynamic simulation of the Surveyor landing, including loads as well as motions; a computer program with error checking control where spacecraft motions and configurations are used to predict the applied forces; a parametric study to consider toppling during planar landings; and development program modifications which permit the calculation of ground slope and cross slope angle as functions of both the vehicle configuration at or prior to touchdown, and the time at which each foot impacts the surface. G.G.

N67-13196*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRAJECTORY DESIGN FOR IMPULSIVE EARTH–MARS–EARTH TRAJECTORIES LAUNCHED IN 1969 AND 1971
Peter H. Feitis 1 Dec. 1966 29 p refs Presented at the Space Flight Mech. Specialist Conf., Denver, 6–8 Jul. 1966
(Contract NAS7-100)
(NASA-CR-80520; JPL-TR-32-1007) CFSTI: HC $2.00/MF $0.50 CSCL 22C

This Report discusses the trajectory design for a spacecraft which returns to the vicinity of the Earth after the Mars encounter. By using a velocity increment, it is often possible to improve the trajectory characteristics or mission payload. The Report also describes the method and associated computer programs used to analyze Earth–Mars–Earth trajectories based on the patched conic model. The return probe can transmit up to 1000 times more data during the Earth-encounter phase than the non-return flyby probe such as the JPL *Mariner IV*. Due to the large communication distances and small transmitter powers involved, the Mars flyby

spacecraft can return severely limited quantities of data. The Mars orbiter can obtain a great deal more data and has been the topic of much investigation. It has been concluded that the 1971 Earth-to-Mars launch period is most advantageous for Earth-return missions, compared to the 1969, 1973 and 1975 Mars opportunities. Author

N67-13202* Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
DESIGN CONSIDERATIONS FOR SURVEYOR GUIDANCE
R. K. Cheng, C. M. Meredith, and D. A. Conrad [1961] 48 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950056)
(NASA-CR-80539) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The Surveyor lunar soft landing spacecraft will provide preliminary unmanned scientific exploration of the surface of the moon. The pertinent design considerations for midcourse guidance and the terminal descent system are discussed. Design of the terminal descent encompasses (1) calculation of fuel requirements based on sensor and propulsion performance characteristics and (2) implementation of the closed loop control scheme required for the terminal portion of the descent. The midcourse correction is made first to correct miss and then, by taking account of terminal descent system characteristics, to maximize the probability of successful soft landing by an appropriate choice of the maneuver component normal to the critical plane. Author

N67-13225*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NON-DISPERSIVE X-RAY EMISSION ANALYSIS FOR LUNAR SURFACE GEOCHEMICAL EXPLORATION
J. I. Trombka, I. Adler, R. Schmadebeck, and R. Lamothe (Melpar, Inc.) Aug. 1966 80 p refs
(NASA-TM-X-55596; X-641-66-344) CFSTI: HC $2.50/MF $0.75 CSCL 22A

An instrument for use in the diagnosis of the lunar surface is described, as well as a computer program for data reduction. The advantages of using alpha particle excitation are discussed, excitation sources are considered, and detector and electronics are described. Data analysis procedures are reported, and details are given on an analytical approach, nature of the pulse-height spectrum, and formulation of the linear least square analysis. Finally, the least square technique is applied to an experimental problem. L.E.W.

N67-13234*# Volt Technical Corp., Washington, D. C.
ON A POSSIBLE STRUCTURE OF THE SURFACE LAYER OF THE MOON [O VOZMOZHNOV STRUKTURE POVERKHNOSTNOGO SLOYA LUNY]
G. N. Dul'nev, Yu. P. Zarichnyak, and B. L. Muratova 22 Nov. 1966 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zavedo., Radiofiz. (Gor'kiy), v. 9, no. 5, 1966 p 849-857
(Contract NAS5-12487)
(NASA-CR-80579; ST-LPS-RA-10539) CFSTI: HC $1.00/MF $0.50 CSCL 03B

An analytical expression has been derived for an effective thermal conduction of bodies of various structures. The solution of an inverse problem is considered, i.e., the determination of the structure of a body by an effective coefficient of thermal conduction. Consideration is also given to a possible structure of the lunar surface layer, based on the analysis of radioastronomical data relative to the parameter $\gamma = (\lambda \rho c)^{-1/2}$ and some additional assumptions. Author

N67-13236*# Volt Technical Corp., Washington, D. C.
ON A COHERENT RADIOEMISSION MECHANISM IN QUASARS AND IN THE REMAINS OF SUPERNOVAE
V. L. Ginzburg and L. M. Ozernoy 14 Nov. 1966 10 p refs Transl. into ENGLISH of a Russian Rept. presented at 29th Symp. of the Intern. Astron. Union, Byurakan, USSR, 3-12 May 1966
(Contract NAS5-12487)
(NASA-CR-80577; ST-IGA-10533) CFSTI: HC $1.00/MF $0.50 CSCL 03B

It is shown that, in principle, coherent mechanisms can be responsible for radioemission in quasars and in the remains of supernovae, without denying or minimizing its role in sources of cosmic radiation. To make the realization of coherent mechanisms possible, an earlier quasistationary model of quasars, the magnetoid, is used. Author

N67-13237*# Volt Technical Corp., Washington, D. C.
RESULTS OF EXPERIMENTS FOR THE DETECTION OF LUNAR IONOSPHERE CARRIED OUT ON THE FIRST MOON'S ARTIFICIAL SATELLITE (LUNA-10)
K. I. Gringauz, V. V. Bezrukikh, M. Z. Khokhlov, G. N. Zastenker, A. P. Remizov et al 17 Nov. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofiz. (Moscow), v. 170, no. 6, 1966 p 1306-1309
(Contract NAS5-12487)
(NASA-CR-80576; ST-LPS-PF-AI-10538) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Experiments on board Luna-10 amount to the delimitation of a zone with increased concentration of charged particles compared to that in interplanetary space. In the evaluation of the results many contingencies are discussed and account has been taken of the respective positions of the moon in the extension of the earth's magnetosphere tail. Special traps were used, and some modifications were made in their design by comparison with the former traps used on the earlier Soviet rockets. Author

N67-13243*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
THE CHEMICAL ANALYSIS EXPERIMENT FOR THE SURVEYOR LUNAR MISSION
Anthony L. Turkevich, Karlfried Knolle, Ernest Franzgrote (JPL), and James H. Patterson (Argonne Natl. Lab.) May 1966 30 p refs Submitted for Publication Prepared jointly with JPL and Argonne Natl. Lab.
(Contract NAS7-100; Grant NsG-127-61; Contracts JPL-950315; JPL-950750)
(NASA-CR-75748; EFINS-66-47) CFSTI: HC $2.00/MF $0.50 CSCL 22A

An experiment has been designed to determine the chemical composition of the lunar surface on the Scientific Surveyor soft-landing missions to the moon. The instrument employed utilizes the characteristic spectra of backscattered alpha particles and protons from (α, p) reactions to establish the elements present in a sample. The instrument can determine the amounts of most elements present in rocks with a sensitivity and accuracy of about one atomic per cent. Satisfactory analyses have been obtained of a variety of terrestrial samples. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N67-12654# Massachusetts Inst. of Tech., Cambridge.
OPTIMAL CONTROL OF MANEUVER-INDUCED VIBRATION IN FLEXIBLE AERO AND SPACE VEHICLES
Dean Karnopp May 1966 22 p refs
(Contract AF 49(638)-1314)
(AFOSR-66-0708; AD-638734) CFSTI: HC $1.00/MF $0.50

Forces applied to a large, flexible aero or space vehicle in order to change the vehicle's attitude or position will in general also excite undesirable vibration. The added cost in terms of time, complexity of thrust pattern and fuel or total control effort required to effect a given maneuver when the unwanted vibration is suppressed in studied in this paper. Techniques for interpreting optimal solutions to these problems are given based on the use of multiple phase plane plots. Author (TAB)

N67-12901*# National Aeronautics and Space Administration, Washington, D. C.
LAUNCH VEHICLE REQUIREMENTS FOR FUTURE AUTOMATED SPACE MISSIONS News Release
Edgar M. Cortright 30 Nov. 1966 17 p AIAA Panel Discussion held at Boston, 30 Nov. 1966 CSCL 22D

The propulsion systems and launch vehicle stages available for future automated planetary and synchronous orbit missions are briefly described and compared to determine if new propulsion systems are needed. The discussion shows that no new propulsion systems or new launch vehicle stages are required for the automated spacecraft missions but that they probably will require adding a modified Centaur as an upper stage on the Saturn IB or the Titan IIIC. They also may require and could use a 260 inch solid first stage under the S-IV-B Centaur. R.N.A.

N67-12931*# Arinc Research Corp., Huntsville, Ala.
THE RELIABILITY OF THE ALL-UP CONCEPT Special Technical Report No. 13
T. T. Jackson, A. D. Tinkelenberg, and D. Van Tijn 15 Jun. 1964 24 p
(Contract NAS8-11087)
(NASA-CR-79732; PUBL-294-02-12-440) CFSTI: HC $1.00/MF $0.50 CSCL 22D

The All-Up concept, which is the concept of conducting the Saturn V research and development launch vehicle program without the use of dummy stages, is considered with respect to implementation approaches. In addition to having a live S-IC stage, all Saturn V launches starting with SA-501 would also have a live S-II second stage, a live S-IVB third stage, live interstages, a completel instrument unit, and a live (but unmanned) Apollo capsule. Preliminary reliability predictions of the Saturn V stages are presented, and data are reviewed from previous launches. S.P.

N67-12961*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
NIMBUS METEOROLOGICAL SATELLITE INTEGRATION AND TESTING Quarterly Progress Report, 16 May--15 Aug. 1966
I. S. Haas 15 Aug. 1966 80 p
(Contract NAS5-978)
(NASA-CR-80347; DOC.-66SD4498) CFSTI: HC $3.00/MF $0.75 CSCL 22B

Progress in the following is reported: (1) Nimbus II flight performance during orbits 1 through 1200; (2) Nimbus B system integration, including electrical definition, interface control, weight, thermal studies, subsystems, equipment status, and bench integration testing; (3) Nimbus B launch vehicle integration, including spacecraft adapter and interface; (4) design and development of Nimbus B electric components, harness, and structure; (5) Nimbus B mechanical and electrical aerospace ground equipment status; (6) Nimbus B data system, including collection, processing, evaluation, and telemetry; (7) testing and evaluation of Nimbus B spacecraft; (8) reliability and failure analyses of Nimbus B spacecraft; and (9) Nimbus B program management. K.W.

N67-13049# European Space Research Organization, Paris (France).
OVERALL CONCEPT OF THE ESRO ASTRONOMICAL SATELLITE
L. A. Hussin (European Space Technol. Centre) Mar. 1966 57 p
(ESRO-SM-65) CFSTI: HC $2.50/MF $0.50

The most important scientific and technical specifications of the LAS are listed, including the scientific instrumentation specifications and the spacecraft design parameters. Possible technical solutions to the design problem of the LAS are reviewed. The conclusion is drawn that the design concept as proposed by ESTEC presents an attractive line of development for the LAS and compares favorably with other overall concepts. Author (ESRO)

N67-13056# European Space Research Organization, Paris (France).
MASS EJECTION SYSTEMS FOR ATTITUDE CONTROL
B. P. Day (RAE) Apr. 1966 20 p refs Lecture given at ESRO Summer School, Oxford, 16 Aug. 1964
(ESRO-TM-29) CFSTI: HC $1.00/MF $0.50

Some of the many different types of low-thrust mass-ejection systems which have been proposed for use in space are summarized, and an elementary approach to the selection of a suitable system for a particular mission is outlined. An example is given where propane would be a suitable choice and reasons for its selection are outlined. The design of a low-thrust cold-gas system is considered and rather more detailed attention is paid to nozzle design and manufacture. Author (ESRO)

N67-13134*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GT-2 FLIGHT TEST DATA. BOOK XII: TIMING, PRESSURE AND ALTITUDE COMPARISONS
19 Jan. 1965 185 p
(NASA-TM-X-56405) CFSTI: HC $3.25/MF $1.00 CSCL 22B

Tabulated data for pressure and altitude differences of the GT-2 flight test are presented. Data are preceded by diagrams of sensor locations, computation procedures, and time in ascent and reentry modes. Plots include absolute pressure information for the Delta forward compartment, the conic section equipment compartment, the landing gear compartment, adapter equipment compartment, and radar cover cavity. S.P.

N67-13166*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENVIRONMENTAL TEST PROGRAM FOR THE ATMOSPHERE EXPLORER-B SPACECRAFT Final Report
W. D. Hoggard 22 Sep. 1966 49 p refs
(NASA-TM-X-55626; X-328-66-508) CFSTI: HC $2.00/MF $0.50 CSCL 22B

The AE-B spacecraft was launched May 25, 1966, from the Eastern Test Range (ETR) aboard a DSV-3c Delta launch vehicle (no. 38). Upon achieving orbit the spacecraft was renamed Explorer 32. Except for failures in the neutral particle mass spectrometer experiment and in the tape recorder, Explorer 32 continues to function well. Author

N67-13194*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER IV MECHANICAL OPERATIONS
Richard J. Upchalski 1 Dec. 1966 16 p ref
(Contract NAS7-100)
(NASA-CR-80619; JPL-TR-32-954) CFSTI: HC $1.00/MF $0.50 CSCL 22B

This report summarizes the salient features of spacecraft mechanical operations based on experience with the *Mariner IV*

spacecraft. The scope of these operations is presented through photographs of various flight and test configurations. Particular operational aspects, including assembly problems, flight preparation, personnel, and documentation, are discussed. General conclusions are drawn regarding spacecraft mechanical operations that may be of value to future space projects. Author

N67-13217*# Volt Technical Corp., Washington, D. C.
LUNA-12 TRANSMITS (TASS COMMUNIQUE)
9 Nov. 1966 9 p Transl. into ENGLISH from Pravda. (Moscow), no. 310 (17627), 6 Nov. 1966
(Contract NAS5-12487)
(NASA-CR-80524; ST-PD-LPS-10536) CFSTI: HC $1.00/MF $0.50 CSCL 22B

Excerpts from the Tass communique on the launching of Lunik XII are presented. Systems design, operation, trajectory, and information transmission are discussed, along with the photo-television device for photographing the lunar surface. Previous achievements of the Soviet moon study program are reviewed. M.G.J.

N67-13223*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME FAILURE PROBLEMS IN SPACECRAFT AND SPACE BOOSTERS
A. J. Babecki, J. D. Grimsley, and H. E. Frankel Jul. 1966 42 p Presented at William Hunt Eisenman Failure Analysis Conf. of the Am. Soc. for Metals, New York, 12–14 Jul. 1966
(NASA-TM-X-55607; X-735-66-406) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Several examples are given to show the common failures of metallic components which occurred during simulated service testing. Some are attributable to excessive stressing which occurs as a result of unrealistically high vibrational specification requirements; others to exhaustion of fatigue design life of the part because it was subjected to an excessive number of repeated mechanical tests. Improper processing and inspection during fabrication, materials selection, and design are identified as other causes. Also considered are the failures which occurred in unmanned scientific satellites during testing of prototype or engineering models. The factors causing corrosion, fatigue, extreme brittleness, and anisotropy are assessed in relation to the use of specific materials. Booster failures are attributed to defects in steel, processing, and fabrication. M.G.J.

N67-13240# Royal Aircraft Establishment, Farnborough (England).
THERMAL CONTROL SURFACES FOR THE U.K.3 SATELLITE
H. A. J. Prentice and J. Porter Apr. 1966 59 p refs
(RAE-TR-66121; AD-487813) CFSTI: HC $3.00/MF $0.75

The selection and evaluation of thermal control surfaces for the U.K.3 satellite is discussed. The surfaces selected were an electrolytically deposited matt gold surface and black and white polymethylmethacrylate paints. These surfaces were evaluated by exposure to simulated charged particle radiation, simulated solar ultra-violet radiation and thermal cycling under vacuum. This evaluation programme exposed certain areas of weakness in our knowledge of the preparation and application of thermal control surfaces for satellites. Future research work to explore these areas and provide technological information for future satellite projects is discussed. Author (TAB)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N67-12389# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
INFLUENCE OF AN AXIAL SUPERSONIC FLOW ON THE BUCKLING OF THIN CYLINDERS UNDER END COMPRESSION
Y. C. Fung Jul. 1966 36 p refs
(Contract AF 49(638)-1364)
(AFOSR-66-1668; AD-639711) CFSTI: HC $2.00/MF $0.50

The combined features of two classical problems of shell instability are discussed, namely, the buckling of a circular cylindrical shell under axial compression, and the panel flutter of such a shell in an axial supersonic flow. In this paper, the static buckling of a shell in a supersonic stream, mathematically described by Donnell's equations and by linear piston theory, is solved. A special assumption with regard to the aerodynamic drag force (or skin friction) is made to simplify the analysis. Closed form solutions are found and are applied to semi-infinite cylinders. Results are obtained for two types of simple-supported edges and two types of clamped edges. The influence of a supersonic flow on lowering the critical buckling load of a circular cylindrical shell under axial compression is shown. The remarkable difference between the aerodynamic effect of a leading edge and a trailing edge is demonstrated. In all the cases examined the leading edge is less stable than the trailing edge. Author (TAB)

N67-12399# Pennsylvania Military Coll., Chester.
NATURAL FREQUENCIES AND DAMPING CAPABILITIES OF LAMINATED BEAMS
R. A. Di Taranto 24 Jun. 1966 61 p refs
(Contract N161-26236)
(MEL-295/66; AD-637272) CFSTI: HC $3.00/MF $0.75

Further analytical investigations are made into the damping capability and determination of natural frequencies of laminated beams, consisting of elastic–viscoelastic–elastic layers, as a means for reducing the vibratory energy transmitted through machine foundation supports in naval vessels. An exact analytical solution is obtained for determining the natural frequencies of simply-supported sandwich beams having no rivets at the ends. Three possible modes of vibration are shown to exist. The case of the simply-supported sandwich beam having rivets at each end is considered and the equations reduced to the solution of 12×12 determinant for calculation on a digital computer. An approximate method is suggested for determining the natural frequencies of sandwich beams having any end conditions. The procedure is simple to use and is exact for simply-supported beams. A simple but approximate expression is also developed for determining the composite loss factors of sandwich beams. The procedure yields good engineering results. Author (TAB)

N67-12453# Drexel Inst. of Tech., Philadelphia, Pa.
LATE-STAGE EQUIVALENCE IN ONE-DIMENSIONAL IMPACTS
Pei Chi Chou and Bruce P. Burns Jul. 1966 28 p refs
(Contract DA-18-001-AMC-876(X))
(Rept.-125-8; AD-639213) CFSTI: HC $2.00/MF $0.50

The attenuation of a strong plane shock produced in a target by the impact of a thin striker is studied by the numerical method of characteristics. The calculated results show that late-stage equivalence exists for impacts in aluminum, copper, and ideal gases with various ratios of specific heats, gamma. The shock fronts produced by different impacts approach each other in position, and in strength, at late times provided that $DU_0\alpha$ is constant where D is the thickness of the striker, U_0 the impact velocity, and α a constant with values of 1.28, 1.50, 1.62, 1.50, and 1.32, for aluminum, copper, and ideal gases with gamma equal to 2.0, 1.4, and 1.1, respectively. Author (TAB)

N67-12459# Illinois Univ., Urbana.
EVALUATION OF FLOW AND FRACTURE PROPENSITY OF NOTCHED STEEL PLATES BY MEANS OF A PHOTOELASTIC MODEL
J. P. Cannon and W. H. Munse Aug. 1966 149 p refs *Its* Structural Res. Ser. No. 314
(Contract Nobs-88283)
(AD-638458) CFSTI: HC $4.00/MF $1.00

The factors affecting brittle strength are examined, with an emphasis on the concept of notch-constraint by which normally ductile metals, such as steel, can be induced to fracture in a brittle manner. Experimental brittle fracture studies are reviewed with an emphasis on tests of notched and welded wide-plates, for which representative data are discussed. A model of the vicinity of the Wells notch used in the wide-plate tests was designed and fabricated out of epoxy material into birefringence was 'frozen.' The use of three-dimensional photoelasticity to examine the stresses in this model, which was loaded so as to simulate the wide-plate specimen, allowed detailed investigation of the stresses in the immediate notch vicinity. On the basis of the stresses found to exist in the Wells notch, three fracture initiation mode possibilities are postulated: (a) a shear mode, initiating at the notch-tip, leading to ductile fracture, (b) shear fracture, initiating at the notch-tip, converging into a cleavage fracture as the region of high triaxiality becomes involved in the fracture process, and (c) cleavage fracture initiating in the region of high triaxiality away from the notch-tip. TAB

N67-12540# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ON THE BUCKLING OF UNSTIFFENED ORTHOTROPIC AND STIFFENED CONICAL SHELLS
Josef Singer Repr. from the Paper Presented at the 7th Congr. Intern. Aeron., Paris, 14–15 Jun. 1965 p 11–22 refs
(Grants AF-EOAR-62-61; AF-EOAR-63-58)
(AFOSR-66-0327; AD-631100)

A linear theory developed earlier for the analysis of the instability of isotropic concical shells under external pressure is described briefly. Recent experiments with electroformed specimens are shown to be even in better agreement with theory than previous tests. Extensions of the method to other loading cases are discussed with their experimental confirmation. Results of a similar method of analysis for clamped conical shells under external pressure are presented. Boundary conditions are discussed in the light of recent conclusions as to their effect on the buckling of cylindrical shells. The extension of the method of analysis for buckling of orthotropic shells under external pressure, torsion and axial compression is then considered, and recent experimental results are described. For stiffened shells, the more accurate approach of 'distributed stiffeners', which permits consideration of the effect of eccentricity of stiffeners, is reviewed. Results for conical shells with uniformly and non-uniformly spaced stiffeners under external pressure are discussed and related to optimization studies. Recent experiments on stiffened conical shells under external pressure and some preliminary tests under axial compression and torsion are then described. The behavior of conical shells under combinad loading is then considered and interaction curves are presented for isotropic and orthotropic conical shells. Author (TAB)

N67-12680# Weidlinger (Paul) Consultants, New York.
STRESSES IN AN ELASTIC–PLASTIC HALF-SPACE DUE TO A SUPERSEISMIC STEP LOAD
Alva T. Matthews and Hans T. Bleich Mar. 1966 73 p refs
(Contract DA-30-069-AMC-8(R))
(TR-4; AD-633776) CFSTI: HC $3.00/MF $0.75

The plane strain problem of a step load moving with uniform superseismic velocity $V>C_p$ on the surface of a half-space is considered for an elastic–plastic material obeying the von Mises yield condition. Using dimensional analysis the governing quasi-linear partial differential equations are converted into ordinary nonlinear differential which are solved numerically using a digital computer. To overcome computing difficulties asymptotic solutions are derived in the vicinity of a singular point of the differential equations. Numerical results are presented for a range of selected values of significant nondimensional parameters, i.e., of the surface load P_0/K of Poisson's ratio ν and of the velocity ratio V/C_p. Author (TAB)

N67-12888# Department of Forestry, Vancouver (British Columbia).
PHOTOSTRESS ANALYSIS OF TIMBER STRUCTURES
C. K. A. Stieda [1965] 38 p refs Repr. from Proc. of 2d Symp. on Nondestructive Testing, 1965 p 349–385
CFSTI: HC $2.00/MF $0.50

Experimental analysis of stresses in orthotropic materials such as wood by means of the photostress method is discussed. Stiffness of photostress coatings and their effect on stresses is considered. Examples given of the analysis of stresses in wood by this method are: stresses in a timber beam near a concentrated load, stresses along the rim of a hole in a wooden compression member, and stresses along a circular notch on the tension side of a wooden beam. Experimental results are compared with analytical solutions. Provided certain restrictions are considered, it is concluded that the photostress method is a useful tool in the analysis of stresses in timber structures. Author

N67-12909*# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.
LONGITUDINAL DYNAMICS OF LIQUID FILLED ELASTIC SHELLS
Daniel D. Kana 30 Sep. 1966 41 p refs
(Contract NAS8-11045; SwRI Proj. 02-1391)
(NASA-CR-79725) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Recent progress achieved in liquid fuel dynamics is discussed. In particular, progress was noteworthy in the areas of the interaction of the liquid and the elastic structure, liquid surface instability, and bubble dynamics. These three areas, as well as other associated problems, are related by their common dependence on the axisymmetric pressure response within the liquid column in the liquid–elastic tank system. Recent studies indicate that this pressure response can be influenced strongly by nonlinear as well as linear vibrations. R.N.A.

N67-12928*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
ON THE VIBRATION OF BEAMS OR RODS CARRYING AN ARBITRARY NUMBER OF CONCENTRATED MASSES
C. L. Ambe-Rao Nov. 1965 20 p refs
(Contract NAS8-5384)
(NASA-CR-79523; WR-65-34) CFSTI: HC $1.00/MF $0.50 CSCL 20K

An easy solution is given to the problem of the free vibrations of simply supported beams carrying an arbitrary number of concentrated masses in an arbitrary way. Finite Fourier sine transforms and the modification of the beam to a variable density beam by the introduction of Dirac δ-functions are utilized in the solution of the problem. The simplified frequency equations corresponding to a single concentrated mass in the middle of the beam and two equally spaced identical concentrated masses are given. For the latter case, some of the roots of the frequency equation are numerically evaluated. Author

N67-12943# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF CYLINDRICAL SHELLS UNDER CREEP
N. M. Matchenko [1966] 2 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 4, 1966 p 165–166

Methods of the theory of stability for small elastoplastic deformations are extended to an investigation of the stability of shells under creep. Experimental data are presented as well as a comparison of computed and test results. Author

N67-12946# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOME PROBLEMS OF ELASTIC–PLASTIC VIBRATIONS OF RODS
A. I. Buravtsev [1966] 6 p refs Transl. into ENGLISH from Vestn. Leningrad Univ. (Leningrad), no. 1, 1965 p 77–83

The problems of simple wave interactions and elastic–plastic loading-wave propagation in a finite rod are considered in detail. Equations are presented for the addition and reflection of two opposing loading waves and the cast of variable velocity at the end of the rod. Two boundary value problems are included for the longitudinal vibration equation of a rod, and finally reflection of the loading wave from the fixed end of the rod is examined. S.P.

N67-12968*# Allied Research Associates, Inc., Concord, Mass.
PRESSURE STABILITY OF PROLATE SPHEROIDS
Herbert Becker 4 Nov. 1966 12 p refs
(Contract NASw-1378)
(NASA-CR-80340; ARA-327-3) CFSTI: HC $1.00/MF $0.50 CSCL 20M

A theoretical investigation of prolate spheroids was conducted using the Donnell type equation for doubly curved shells. The results cover the range from a sphere to a cylinder, and show how the simplified form of Mushtari's relation is approached asymptotically from above within that range. Theory and experiment are shown to be in reasonable agreement for some of the test data available. However, the simplified theoretical approach underestimated the strengths of shells with large axis ratios. Author

N67-12973*# Allied Research Associates, Inc., Concord, Mass.
ENERGY DISSIPATING STRUCTURES: A STRUCTURES-MATERIALS-DESIGN SYNTHESIS
George Gerard 11 Aug. 1964 25 p refs
(Contract NASw-928)
(NASA-CR-80334; TR-268-1) CFSTI: HC $1.00/MF $0.50 CSCL 20K

An analysis of several forms of ideal energy dissipating mechanisms is presented which synthesizes the weight or mass index in terms of pertinent design indices, structural efficiency and material efficiency parameters. For the landing problem, the primary design index is the touchdown velocity while a secondary design index is associated with the payload fragility in terms of deceleration and onset rate limitations. The structural design of energy dissipators is then considered in terms of structural and material efficiency parameters. It is shown that the large body of available information on optimum structural design is directly applicable and has an important bearing on attainable structural efficiencies. Finally, various forms of cylindrical shell dissipators such as buckled and frangible tubes and pressurized membranes and shells are compared. Author

N67-13000# Georgia Inst. of Tech., Atlanta. School of Engineering Mechanics.
AXISYMMETRIC DYNAMIC RESPONSE OF SPHERICAL AND CYLINDRICAL SHELLS
James Ting-shun Wang, Chi-Wan Lin, and Wolfram Stadler [1966] 13 p refs Presented at the Am. Astron. Soc. Southeastern Symp. on Missiles and Aerospace Vehicles Sci., Huntsville, Ala., 5–7 Dec. 1966
(Grant NsG-571)
(NASA-CR-80370) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The mode-acceleration or Williams method is used to obtain the axisymmetric response, due to an arbitrary time-dependent loading, of a complete spherical shell, and of hemispherical shells with roller-hinged, roller-clamped and completely fixed edge. Numerical examples, where the shells are subjected to simple time-dependent loads, are presented. The same method is used in the study of a cylindrical shell with clamped-edge boundary conditions. A numerical example of a cylindrical shell subjected to a linearly decaying load, uniformly distributed over the shell, is included. The results here compare favorably with solutions obtained by means of a modal analysis in a previous investigation of the problem by the authors. Author

N67-13003*# Wyle Labs., Inc., Huntsville, Ala.
JOINT ACCEPTANCE FOR CYLINDERS IN REVERBERANT ACOUSTIC FIELD Progress Report
A. Wenzel and L. C. Sutherland Sep. 1966 12 p Prepared for Brown Eng. Co.
(Contract NAS8-20073-1)
(NASA-CR-80359; TM-65-19) CFSTI: HC $1.00/MF $0.50 CSCL 20K

A brief derivation of the equation for the joint acceptance squared as a function of the normal modes and the cross spectral density of the forcing function is given for the case of a general body undergoing random vibration. As a basis for calculating the cross spectral density, the problem of scattering is solved for the case of a plane acoustic wave impinging on an infinite rigid cylinder. Solutions are also developed for the joint acceptance of a simply supported beam in a diffuse sound field. The results show that the diffuse field serves to smooth out the sharp nulls in joint acceptance present for a progressive field. In addition, the joint acceptance for a diffuse field is much higher at high frequencies, and tends to become independent of mode number. M.G.J.

N67-13012*# Ampex Corp., Redwood City, Calif.
THE DYNAMIC BEHAVIOR OF A FOIL IN THE PRESENCE OF A LUBRICATING FILM
A. Eshel and M. Wildmann Sep. 1966 28 p ref
(NASA Order H-76799; Contract Nonr-3815(00)(X))
(NASA-CR-80148; RR-66-29) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Equations for the oscillations of a foil over a lubricating fluid film are derived and are simplified by a small parameter expansion. A few particular cases are discussed, and a linearized solution is obtained for the case of a massless, perfectly flexible foil moving at a speed U over an incompressible film. The solution reveals the phenomenon that small disturbances in the film thickness, as well as symmetrical large disturbances, propagate at a speed U/2. Author

N67-13065# Lockheed Missiles and Space Co., Palo Alto, Calif.
VIBRATIONS OF NONCIRCULAR CYLINDRICAL SHELLS
R. L. Malkina [1966] 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 1, 1960 p 172–175

The problem of vibrations of noncircular cylindrical shells is considered and the obtained results are compared with those known for the corresponding circular shells. Author

N67-13146# Department of Forestry, Vancouver (British Columbia). Forest Products Research Branch.
EXPERIMENTAL STUDY OF THE DEFORMATION OF A "PLEXIGLAS" SPHERE PRESSED BETWEEN TWO RIGID PARALLEL PLANES OUTSIDE THE RANGE OF ELASTICITY [ETUDE EXPERIMENTALE DE LA DEFORMATION D'UNE SPHERE DE PLEXIGLAS COMPRIMEE ENTRE DEUX PLANS PARALLELES RIGIDES EN DEHORS DU DOMAINE ELASTIQUE]
P. Dantu Apr. 1964 22 p refs Transl. into ENGLISH from Ann. des Ponts et Chaussees (France), v. 132, no. 5, Sep.–Oct. 1962 p 555–578 /*ts* Transl. No. 214
CFSTI: HC $1.00/MF $0.50

The moire, or fringe technique has been applied to a problem of three-dimensional plasticity: deformation of a Plexiglas sphere, 45 mm. in diameter, pressed between two rigid parallel planes. The method applied, experimental details, and results are described. In this problem of revolution, the technique makes it possible to determine the magnitude and direction of the three principal strains at any point inside or on the contour. Some data are given on the future potentialities of the fringe technique in the problems of three-dimensional plasticity and elasticity. Author

N67-13178*# Rochester Univ., N. Y.
MATRIX HOLZER ANALYSES FOR FULLY-COUPLED VIBRATIONS OF CLUSTERED LAUNCH-VEHICLE CONFIGURATIONS INCLUDING APPLICATIONS TO THE TITAN IIIC AND UNCOUPLED SATURN I CASES
Robert G. Loewy and Mukund M. Joglekar Washington, NASA, Dec. 1966 138 p refs
(Grant NsG-469)
(NASA-CR-592) CFSTI: HC $3.00/MF $1.00 CSCL 20K

A general matrix-Holzer method is developed for predicting the free vibration modes of clustered launch vehicles. The problem is so formulated that it can be adapted to the analysis of clustered structures capable of vibrating in various types of modes. A complete theoretical analysis of the fully-coupled vibrations of the Titan IIIC launch vehicle is followed by analysis of the transverse bending vibrations of the Saturn I. The latter is a simplification of the fully-coupled case specialized to the Saturn cluster boundary conditions. The first six transverse bending modes of the NASA Saturn I 1/5 scale model are calculated and compared with test results. A procedure for predicting the longitudinal vibration modes of Saturn I is also presented, and represents a second specialization of the fully coupled case. The formulation minimizes numerical operations by invoking symmetry where possible and by postponing satisfaction of compatability of deflections at cluster attachments until the last steps. Author

N67-13257*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AN INCREMENTAL PROCEDURE FOR SOLUTION OF NONLINEAR PROBLEMS WITH APPLICATIONS TO PLATES AND SHELLS
Manuel Stein Washington, NASA, Dec. 1966 28 p refs
(NASA-TN-D-3768) CFSTI: HC $2.00/MF $0.50 CSCL 20K

An incremental step-by-step procedure is described for obtaining solutions to nonlinear boundary value problems. This procedure is especially suited for computer solution of problems cast in numerical form; it is used to obtain numerical solutions for the clamped plate with uniform lateral load, for the stretched simply supported plate with a central concentrated load, and for a spherical cap with internal pressure and an outward acting central concentrated load. There is good agreement between the present results and exact results which have been obtained previously. Author

N67-13323# General Electric Co., Cincinnati, Ohio. Nuclear Technology Dept.
DEFCOT: PLANE-STRAIN PLASTIC–VISCOELASTIC DEFORMATION OF A COMPOSITE TUBE
J. P. Yalch Jun. 1966 54 p refs Supersedes GEMP-288; see N65-32317
(Contract AT(40-1)-2847)
(GEMP-415; GEMP-288) CFSTI: HC $3.00/MF $0.50

A method and an associated computer program are described for calculating during successive time intervals the plastic stress/strain distributions in long hollow circular composite cylinders having a variable axisymmetric temperature distribution, subjected to axial load and internal and external pressures. The analysis and computer program reported in GEMP-288 was modified and corrected so that: the cylinder may be composed of more than two concentric cylinders, and the innermost cylinder may be solid; external pressures may be added to the input; the axial load function input is more convenient; equations were modified; the program was converted to the Fortran IV language for the GE 625/635 machines; and inputs were simplified and outputs were expanded. NSA

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N67-12625# National Engineering Lab., Glasgow (Scotland).
HEAT BIBLIOGRAPHY, 1964
I. Murray, ed. Edinburgh, HMSO, 1965 516 p refs
CFSTI: HC $8.15/MF $2.25

Included in this heat bibliography are references to analogies; atomic energy; automatic control; bibliographies and books; boilers and boiling; chemical and physical properties of pure substances; chemical engineering; combustion; computation; condensation; condensers; conduction; convection; cooling; corrosion and fouling; diffusion; dimensions, units, and standards; direct conversion; distillation; dryers; economics; evaporation; experimental and operational techniques; fins and extended surfaces; fluid flow; fluidized and packed beds; freezing and melting; furnaces; gas turbines; general works on heat transfer, heat exchange, and thermodynamics; hazards; heat engines; heat exchangers; heat pumps; heat transfer coefficients; heat transfer media; unsteady heat transfer; heating and ventilation of buildings; insulation; materials with special properties; magnetohydrodynamics; mathematics; meteorology; multiphase flow; data and methods of measuring physical properties; theoretical physical properties; power plant; radiation; refrigeration; solar heat; surface effects; and thermodynamics. R.N.A.

N67-12634# India. Dept. of Atomic Energy, Bombay.
APPARATUS FOR THE THERMAL CONDUCTIVITY DETERMINATION OF SOME ORGANIC COOLANTS USED IN NUCLEAR REACTORS
K. Natarajan, M. P. S. Ramani, and D. G. Vartak 1966 27 p refs
(AEET-245) CFSTI: HC$2.00/MF$0.50

The investigation deals with the designing of a suitable apparatus for the measurement of thermal conductivity of organic liquids used in nuclear reactors. At the first instance, the apparatus was employed to determine the thermal conductivity of water and nitrobenzene. Then the thermal conductivity of reactor coolants such as Dowtherm, Santowax O.M. monoisopropyl biphenyl, o-terphenyl, m-terphenyl, p-terphenyl and Santowax-R were determined and values compared with those available in literature. Author

N67-12759*# Martin Co., Baltimore, Md.
RESEARCH ON REFURBISHABLE THERMOSTRUCTURAL PANELS FOR MANNED LIFTING ENTRY VEHICLES
A. H. La Porte Washington, NASA, Nov. 1966 229 p refs
(Contract NAS1-5253)
(NASA-CR-638) CFSTI: HC$3.75/MF$1.25 CSCL 20K

Off-the-shelf materials and structural refurbishable composite thermostructural heat shield panel configurations were studied for manned lifting entry vehicles. Structural optimization studies were performed on some substrate panel configurations to determine optimum weights within a set of design constraints. The interrelationship between required panel support spacing and capabilities of ablator and substrate panel materials was found to be significant; and the concept of an integral insulation/support system was shown to offer potential design advantages. Comparison was made of total shield weights for the two most promising systems on the HL-10 reentry vehicle, and additional studies were made of the selected concept which consisted of an elastomeric ablator supported by a honeycomb matrix bonded to a phenolic/glass laminate honeycomb substrate panel. The panel is supported on the vehicle by molded phenolic/glass laminate flanged cups, and the gap between panel and vehicle is filled with multilayer microquartz insulation material. M.W.R.

N67-12795*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PARAMETRIC STUDY OF A LOW-DENSITY CHARRING ABLATOR
Stephen S. Tompkins and Marvin B. Dow Washington, NASA, Dec. 1966 28 p refs
(NASA-TN-D-3735) CFSTI: HC$2.00/MF$0.50 CSCL 20M

The results of a parametric study of a representative low-density charring ablator, obtained from an ablation analysis programmed for solution on a high speed digital computer are presented and discussed. The thermal performance of the charring ablator was examined over a range of environmental conditions. The results show that the thermal performance of a charring ablator is strongly influenced by the environmental conditions, particularly stream enthalpy and oxygen concentration. The results also show that the effect of material properties on thermal performance depends upon the stream enthalpy level. Author

N67-12799*# National Aeronsutics and Space Adminstration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF SURFACE ABLATION OF NONCHARRING MATERIALS WITH DESCRIPTION OF ASSOCIATED COMPUTING PROGRAM
Fred W. Matting and Dean R. Chapman Washington, NASA, Dec. 1966 81 p refs
(NASA-TN-D-3758) CFSTI: HC$2.50/MF$0.75 CSCL 20M

A generalized method is presented for solving the problem of stagnation-point heat transfer and material response for blunt bodies experiencing melting and vaporizing or subliming ablation. The analysis is applicable to wind-tunnel and flight conditions (with body forces taken into account); internal radiation can be considered or the material can be assumed opaque; the analysis can be used for different planets. During entry flights, a body will start in the free-molecule regime, pass through a transitional regime, and finish in the continuum regime of gas dynamics. Approximate equations are presented which provide bridges between the free-molecule and continuum regimes for such quantities as the convective heating rate, surface shear, heat blockage, and mass loss. Several examples show applications of the analysis. Comparisons with experiment are made where possible. The analysis has been machine programmed for numerical solutions using a finite difference scheme, and a running energy valance is kept as a check on accuracy. Instructions are also provided for using the computing program. Author

N67-12816*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF SOLIDIFICATION IN THERMAL-ENERGY STORAGE SYSTEMS WITH AXISYMMETRIC HEAT-TRANSFER SOLUTIONS
Richard R. Cullom, George Diedrich, and Lynn U. Albers Washington, NASA, Dec. 1966 27 p refs
(NASA-TN-D-3763) CFSTI: HC$1.00/MF$0.50 CSCL 20M

An analysis was made of a transient heat conduction problem with a phase change in the axisymmetric conducting medium and heat transfer at the inner radius only. Nondimensional finite difference solutions for surface temperature and solidification thickness were obtained for a range of time, initial heat rejection rate, tube diameter, and storage material properties. Although the configuration of a tube submerged in a thermal energy storage material which is at its fusion temperature applies to space auxiliary power systems, the nondimensional solutions presented in this report can be applied to a wide range of axisymmetric solidification problems, such as metal casting and ice formation. To illustrate their application, the general solutions were used in an analysis of a lithium hydride thermal energy storage system. Analysis indicates that the use of axisymmetric solutions are recommended over the simple one dimensional solutions for low radii or long dark times to prevent inefficient overdesign of the thermal energy storage component. The storage material surface temperature is more sensitive to changes in heat rejection rate than to changes in either cooling time or heat transfer surface radius. The solidification thickness is a stronger function of cooling time than either heat transfer rate or surface radius. Author

N67-12819# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
MEASUREMENT OF THERMAL FLUX IN VERY BRIEF OVERFLOW [MESURES DES FLUX THERMIQUES DANS LES ECOULEMENTS TRES BREFS]
Jean Maulard 1966 19 p In FRENCH Presented at the Hypersonic Aerodyn. and the Tech. of the Study of Rapid Phenomena Colloq., St. Louis, France, 14–15 Jun. 1966
(TP-372(1968)) CFSTI: HC$1.00/MF$0.50

Wind tunnel measurements of heat flux in very short flows are discussed. Miniaturized thermal inertia fluxmeters and surface temperature fluxmeters, because of their short response time, were used, and the data gathered were considered satisfactory. Heat flux either at the wall or on the model were calculated with 15% accuracy. Photographs, cross sections, and graphs of the wind tunnels, components, and fluxmeters complete the descriptive data. Transl. by R.U.

N67-12852# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
PROGRAMMED METHOD FOR THE DETERMINATION OF PROPELLANT CHARACTERISTICS (MIXED EXPANSION) [METHODE PROGRAMMEE DE CALCUL DES PERFORMANCES DE PROPERGOLS (DETENTE MIXTE)]
Bernard Crampel, Simone Barrere, and M. Paule Lemaitre 1965 223 p refs In FRENCH; ENGLISH summary
(NT-92(1965)) CFSTI: HC $6.00/MF $1.25

CONTENTS:

1. METHOD OF DETERMINATION—INITIATION AND EXPLOITATION OF THE PROGRAM B. Crampel and S. Barrere p 8–89 refs (See N67-12853 03-33)

2. DESCRIPTION AND OPERATION OF THE PROGRAM P. Lemaitre p 93–124 refs (See N67-12854 03-33)

3. FORTRAN LEXICON AND LIST OF THE SYMBOLIC PROGRAM P. Lemaitre p 127–222 (See N67-12855 03-08)

N67-12853# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
METHOD OF DETERMINATION—INITIATION AND EXPLOITATION OF THE PROGRAM [METHODE DE CALCUL—MISE EN OEUVRE ET EXPLOITATION DU PROGRAMME]
Bernard Crampel and Simone Barrere *In its* Programmed Method for the Determination of Propellant Characteristics (Mixed Expansion) 1965 p 8–89 refs In FRENCH (See N67-12852 03-33) CFSTI: HC $6.00/MF $1.25

The computer method, program operation, and data sheets are presented in connection with a study of propellant performance. A hypothesis is formulated for equilibrium gas flow along the nozzle. Calculation of the enthalpy, isentropic expansion, propellant composition, and specific heat are briefly reported. Attached data sheets show the computer printout calculation used. Transl. by R.U.

N67-12854# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
DESCRIPTION AND OPERATION OF THE PROGRAM [DESCRIPTION ET FONCTIONNEMENT DU PROGRAMME]
Paule Lemaitre *In its* Programmed Method for the Determination of Propellant Characteristics (Mixed Expansion) 1965 p 93–124 refs In FRENCH (See N67-12852 03-33) CFSTI: HC $6.00/MF $1.25

The computer method, program description, and working conditions for a propellant testing program are presented, along with various observations on pre-computation procedures. Formulas are reported for calculating concentration, enthalpy, specific heat, coefficient of isentropic expansion, and the speed of sound. Propellant performance is calculated from results obtained for each point on the equilibrium curve. The computer program covers calculations of conditions in the chamber, the curve of isentropic expansion in equilibrium, determination of conditions at the throat, and calculation of propellant performance. Transl. by R.U.

N67-12899# Fiat S.p.A., Turin (Italy). Sezione Energia Nucleare.
FORCED CONVECTION BURNOUT AND HYDRODYNAMIC INSTABILITY EXPERIMENTS FOR WATER AT HIGH PRESSURE. PART III: COMPARISON BETWEEN EXPERIMENTAL BURNOUT DATA AND THEORETICAL PREDICTION FOR UNIFORM AND NON-UNIFORM HEAT FLUX DISTRIBUTION
G. Previti, P. Grillo, A. Campanile, G. Galimi (Soc. Ric. Impianti Nucl., Saluggia, Italy), and M. Goffi Brussels, EURATOM, Aug. 1966 139 p refs Prepared Jointly with Soc. Ric. Impianti Nucl. and Ansaldo S.p.A.
(Contract EURATOM-008-61-12 PNII)
(EUR-3113.e) CFSTI: HC $4.00/MF $1.00

The increase of power output from a pressurized water reactor core with constant hot channel factors depends largely upon a more accurate prediction of DNB conditions (Departure from Nuclear Boiling or burnout phenomenon). The finality of the present work is to compare the experimental data obtained for conditions peculiar of small PWR cores with the predictions of several correlations chosen among the existing ones for their reliability. The data cover both uniform and non-uniform power distributions as well as unheated wall effect. Although a large fraction of the collected data have been obtained for tanker reactor design conditions, a certain number of parameters such as pressure, mass flow rate, inlet enthalpy, and diameter have been investigated so that the comparison here presented will have a broader interest. Author

N67-12977*# Louisana State Univ., Baton Rouge. Reacting Fluids Lab.
SOLUTION OF THE FROZEN FLOW MOMENTUM EQUATION Status Report
Gary C. April, Eduardo G. del Valle, and Ralph W. Pike 1 Oct. 1966 60 p refs
(Grant NGR-19-001-016)
(NASA-CR-80348; NASA-RFL-5) CFSTI: HC $3.00/MF $0.75 CSCL 20M

The solution of the momentum equation for frozen flow in the char zone of a charring ablator is presented, including an inertial as well as the viscous term. The results are given as pressure profiles and/or pressure drops across the char layer. In general the pressure drop varied from 0.41 (2.12 lb/ft^2) to 3.51 (17.91 lb/ft^2) inches of water over a range of conditions bounded by the values of mass flux, porosity, and surface temperature. The value of the heat flux at the char surface varied from 7.4 to 67.7 BTU/ft^2-sec over the same range of parameter values. Also included are results indicating the effect of each of the parameters on the temperature profile. K.W.

N67-12993*# National Bureau of Standards, Boulder, Colo.
THERMODYNAMIC PROPERTY CHARTS OF SATURATED LIQUID PARAHYDROGEN IN BRITISH UNITS
R. D. Mc Carty and H. M. Roder 15 Nov. 1966 54 p ref
(NASA Order R-06-006-046)
(NASA-CR-80363; NBS-9263) CFSTI: HC $3.00/MF $0.50 CSCL 20M

Six temperature-entropy diagrams for parahydrogen in the neighborhood of the saturated liquid are presented. The six diagrams (about 19×30 inches in size) cover the temperature range from 29.16° to 42.48°R (16.2° to 23.6°K) with pressures to 100 psia (6.8046 atm) and mixtures of the liquid and vapor phases to 0.003 quality. Author

N67-12998*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
THERMAL SCALE MODELING IN A SIMULATED SPACE ENVIRONMENT Technical Summary Report, Jun. 1, 1964–Apr. 30, 1966
R. E. Rolling Jun. 1966 127 p refs
(Contract NAS8-11152)
(NASA-CR-80372; N-05-66-1) CFSTI: HC $4.00/MF $0.75 CSCL 20M

A program is described which was conducted to determine the accuracy of models in predicting steady state and transient thermal performance in the space environment. The study was primarily experimental in nature since a laboratory demonstration was desired. The configurations chosen for test were geometrically simple, but provided the thermal complexity of spacecraft systems in current use. The test objectives were subjected to a simulated

thermal near-earth orbit, as well as a steady state heat flux input. The program established the feasibility and accuracy of thermal modeling on simple geometries having complex thermal behavior. The models provided reliable forecasts of both steady state and transient phenomena for scale ratios of approximately 1/2 and 1/4. The overall absolute temperature prediction accuracy was about 3% for disks and 1% for cones. These results provide substantial evidence that model studies can furnish reliable predictions of full scale thermal performance in the space environment. R.N.A.

N67-13109*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ANALYTICAL AND EXPERIMENTAL STUDY OF STRATIFICATION AND LIQUID-ULLAGE COUPLING, 1 JUNE 1964–31 MAY 1965
J. H. Chin, E. Y. Harper, F. L. Hines, S. E. Hurd, and G. C. Vliet 1 Aug. 1965 156 p refs
(Contract NAS8-11525)
(NASA-CR-80472; LMSC-2-05-65-1) CFSTI: HC $5.00/MF $1.00 CSCL 20M

A theoretical closed-form solution for predicting stratification of subcooled fluids in cylindrical containers subjected to uniform sidewall heating was extended to consider combined uniform sidewall heating as well as asymmetric sidewall heating with or without bottom heating. The solution is based on the assumption of time-invariant dimensionless temperature profiles in the thermal stratified layer. For stratification in a liquid near saturation, an analytical model that includes the coupling between liquid and ullage vapor was developed. The model is based on the closed-form solution, but considers mass and energy transfer at the liquid–vapor interface. A computer program that solves the basic equations to give the ullage pressure and temperature and the liquid temperatures was written. Also investigated was the effect of nucleate boiling on stratification. A solution for a boiling free-convection boundary layer on a vertical flat plate was obtained, and the results of the solution were then used in the stratification prediction. Other work efforts regarding stratification experiments with different noncryogenic fluids in three different vessels; and the correlation of cryogenic stratification data, are also discussed. L.S.

N67-13131*# Therm, Inc., Ithaca, N. Y.
COMPENSATION FOR NONLINEAR EFFECTS DUE TO HIGH HEAT FLUX IN THIN-FILM THERMOMETRY
J. W. Reece and R. W. Hale Jun. 1966 43 p refs
(Contract NAS8-20202)
(NASA-CR-80482; TAR-TR-6601) CFSTI: HC $2.00/MF $0.50 CSCL 20M

A program of theoretical and experimental research has been carried out to devise practical means for compensating the electrical output of thin-film resistance thermometers for deviations from ideal performance that result when these gages are used to measure large heat transfer rates. These deviations have their source in an increase in the surface temperature of the gage of a sufficient magnitude to affect the materials properties—the thermal conductivity and thermal diffusivity of the substrate material, and the thermal coefficient of resistivity of the resistance element. It is shown that these temperature sensitive effects can be combined mathematically in a single correction factor and applied as an operation on the gage output. In practice this means that the gage output voltage is subjected to electrical compensation before it is introduced as the input to a conventional heat transfer analog unit. Recent data on the pertinent materials properties have been used to evaluate the coefficients involved in the correction factors. Two different types of compensator network were then designed and built. Author

N67-13148# Department of Forestry, Vancouver (British Columbia). Forest Products Research Branch.
HEAT TRANSFER COEFFICIENTS FOR BLOWING ON A PLANE SURFACE THROUGH HOLES AND SLITS [VARMEOVERGANGSTAL VID PABLASNING AV EN YTA GENOM HAL OCH SLITSAR]
Claes Allander and Jan-Mats Eneroth 5 May 1964 8 p Transl. into ENGLISH from Svenskpapperstid. (Stockholm), v. 66, no. 9, 15 May 1963 p 349–352 *Its* Transl. No. 215
CFSTI: HC $1.00/MF $0.50

Heat transfer coefficients for blowing on a plane surface through holes and slits were compared in relation to obtaining the highest specific evaporation in paper drying. The test method is described in detail, and a numerical example is given. The heat transfer coefficients calculated from the temperature differences measured at each test series were plotted as a function of the air speed under otherwise constant conditions. Results indicated that with similar hydraulic data and for the same applied specific output, the heat transfer coefficient for round holes will be 25 to 40% higher than for slits. L.E.W.

N67-13160#
HEAT TRANSFER WITH RECEDING BOUNDARIES AND OTHER COMPLICATIONS
Simon Ostrach [1963] 100 p refs

Analyzed are the physical phenomena of pure heat conduction with moving interface for materials which melt before they vaporize. Deductive methods are employed to obtain design criteria for aerodynamic forebodies under consideration of their heat stagnation region. Detailed discussions describe the aerodynamic melting ablation process during manned vehicle reentry with its low intensity long-duration heating during which melting can occur before vaporization, and entry flight dynamics and melting ablation theory are then applied to the question of the origin of tektites. An effort is made to clarify the relation of concentric ring waves on tektite surfaces with the dynamics and heat transfer of a body. G.G.

N67-13167*# Syracuse Univ. Research Inst., N. Y. Dept. of Mechanical and Aerospace Engineering.
STUDY OF NOVEL REFRIGERATION METHODS Final Report
William E. Gifford Oct. 1966 151 p refs Prepared for JPL
(Contract NAS7-100)
(NASA-CR-80513) CFSTI: HC $5.00/MF $1.00 CSCL 20M

Consideration has been given to pulse tube and cryomatic gas balancing cryogenic refrigeration methods. Although the goal for the work has been the low temperature of 4.2° K, much of the research has been concerned with experimentation at much higher temperatures. Single stage units of the pulse tube refrigeration method have achieved temperatures to 43° K but it is doubted that temperatures lower than approximately 30° K will ever be achieved with this method. Cryomatic gas balancing obtained better results with temperatures of 4.2° K being attained and maintained reliably. In addition, an investigation of thermal regenerators is discussed. A.G.O.

N67-13169*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF FREQUENCY RESPONSE CHARACTERISTICS OF PROPELLANT VAPORIZATION
Marcus F. Heidmann and Paul R. Wieber Washington, NASA, Dec. 1966 22 p refs Presented at the 2d AIAA Propulsion Joint Specialist Conf., Colorado Springs, 13–17 Jun. 1966
(NASA-TN-D-3749) CFSTI: HC $1.00/MF $0.50 CSCL 21B

The dynamic response of a droplet vaporization process excited by traveling transverse acoustic oscillations is derived by

a linear analysis. Results of a previous nonlinear numerical study used to formulate the analytical model are reviewed, and a transfer function representative of the dynamics of the vaporization process is derived. The analysis provides dimensionless parameters related to propellant physical properties that characterize the dynamic behavior of the vaporization process. Application is made to the vaporization of heptane, oxygen, fluorine, ammonia, and hydrazine. The dynamic response of these propellants attains a peak value at a particular frequency. A comparison is made with a burning-rate process described by a characteristic time and an interaction index giving similar behavior. Author

N67-13181*# Hydronautics, Inc., Laurel, Md.
CAVITATION DAMAGE IN LIQUID METALS (POTASSIUM STUDIES) Technical Progress Report, 10 Jan.–31 Jul. 1966
H. S. Preiser and S. L. Rudy 29 Sep. 1966 39 p refs
(Contract NAS3-6506)
(NASA-CR-72088; TPR-607-1) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The existing dry box facility has been modified and calibrated for conducting high-temperature liquid-potassium cavitation damage tests. Oxygen and moisture in the argon cover gas in the dry box can be maintained below 5 ppm for 1 hour with the glove ports closed. An 8-hour potassium purity test under operating conditions was made and oxide impurity levels were maintained well below 50 ppm. Instrumentation for monitoring amplitude of the magnetostriction device has been installed in the air-cooled free end of the transducer, away from contact with liquid metal vapor. A program for cavitation damage tests under various temperature and pressure parameters is in progress. The materials selected are TZC, T-111, TiC, and Cb-132M Author

N67-13189*# Thiokol Chemical Corp., Huntsville, Ala.
AN ANALYTICAL STUDY OF THE EFFECTS OF RADIAL ACCELERATION UPON THE COMBUSTION MECHANISM OF SOLID PROPELLANT Final Report, 19 Aug. 1965–18 Aug. 1966
Robert L. Glick Dec. 1966 115 p refs
(Contract NAS7-406)
(NASA-CR-66218; Rept.-42-66) CFSTI: HC $3.00/MF $0.75 CSCL 21B

Theoretical studies were made of the effect of spin on the internal ballistics at fixed time of rocket motors with axisymmetric grains and the effect of acceleration on the burning rate of metallized and nonmetallized composite propellants. In the internal ballistics studies a relatively general internal ballistics at fixed time computer program was written and the effects of spin on a single nozzle motor with a CP grain possessing inhibited ends were computed. The numerical study showed that the major spin induced effects in single nozzle motors with CP grains possessing inhibited ends are attributable to acceleration induced burning rate changes and nozzle effects due to the swirling flow. In the burning rate studies a theoretical model based on particle burning was developed for metallized composite propellants, and a theoretical model based on the granular diffusion flame combustion model was developed for nonmetallized composite propellants. The trends predicted by the theoretical metallized propellant model relative to variations in burning rate coefficient and pressure exponent with acceleration and in burning rate with the direction of the acceleration force were in qualitative agreement with the experimental data. Author

N67-13278# General Electric Co., San Jose, Calif. Advanced Products Operation.
IMPROVED HEAT TRANSFER PERFORMANCE WITH BOUNDARY LAYER TURBULENCE PROMOTERS
William A. Sutherland Jun. 1966 25 p refs
(Contract AT(04-3)-189)
(GEAP-5115) CFSTI: HC $1.00/MF $0.50

A substantial improvement in forced-convection heat transfer conductance is required for the development of advanced steam-cooled and gas-cooled power reactor systems. Boundary layer turbulence promoters on the heated surfaces are of great interest for these systems because of the large increase in the heat transfer performance which can be attained. The performance of boundary layer turbulence promoters in arrays of parallel rods is established. Discrete two-dimensional roughness elements, in the form of small fins transverse to the flow, are investigated experimentally to establish the effect of promoter height and promoter spacing. A general correlation is presented which then permits optimization of heat transfer performance. Author (NSA)

N67-13329# Oak Ridge National Lab., Tenn.
APPROPRIATE VALUES FOR THE THERMAL CONDUCTIVITY OF UO_2 FOR USE IN THE DESIGN OF THE BONUS SUPERHEATERS
J. P. Sanders 22 Apr. 1966 8 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1450) CFSTI: HC $1.00/MF $0.50

A survey of the current literature was made to determine the most appropriate values for the thermal conductivity of UO_2 to use in the reevaluation of the design of the BONUS superheater elements. Two types of thermal conductivities are encountered in the literature; these are effective thermal conductivities, which include the resistance of a gas gap between the fuel and cladding, and absolute thermal conductivities, which are based on measurements made in continuous blocks of UO_2. Effective and absolute values were found to differ both in magnitude and temperature difference. The values were also found to be dependent upon irradiation and thermal-cycling history. The best values for the absolute thermal conductivity as a function of temperature are reported. It is also recommended that, in the range of temperature encountered in the BONUS superheater assemblies, an appropriate average effective thermal conductivity in the range of 1.0 to 1.2 Btu/hr x ft x °F be used. Author (NSA)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N67-12626*# National Aeronautics and Space Administration, Washington, D. C.
TECHNICAL PROGRESS AND OBSOLESCENCE [PROGRES TECHNIQUE, FISCALITE, OBSOLESCENCE]
C. Sarthou et al Apr. 1966 146 p refs Transl. into ENGLISH from Cahier d'Etudes of the Groupe d'Etudes, Recherche et Developpement de l'Association Francaise Pour l'Accroissement de la Productivite (France), no. 2, 1964
(NASA-TT-F-10467) CFSTI: HC $4.00/MF $1.00 CSCL 05C

CONTENTS:

1. TECHNICAL PROGRESS, FISCAL AFFAIRS, OBSOLESCENCE C. Sarthou et al p 1–41 refs (See N67-12627 03-34)

2. FISCAL MEASURES FOR ENCOURAGING SCIENTIFIC RESEARCH F. Panel (GE) p 42–51 (See N67-12628 03-34)

3. SPECIAL DISPOSITIONS FOR RESEARCH ACTIVITIES BY BUSINESS ENTERPRISES p 51–71 (See N67-12629 03-34)

4. POTENTIALITIES AND DANGERS OF TECHNOLOGICAL EVOLUTION J. R. Bright p 72–101 (See N67-12630 03-34)

5. RESEARCH, DEVELOPMENT, AND GROWTH G. W. Wilson p 102–109 refs (See N67-12631 03-34)

6. REPLY TO G. W. WILSON R. Solo p 110–116 ref (See N67-12632 03-34)

7. ANALYSIS OF THE "ROLE AND EFFECT OF TECHNOLOGY ON THE NATIONAL ECONOMY" OF THE UNITED STATES J. C. Arinal p 117–137 refs (See N67-12633 03-34)

N67-12627*# National Aeronautics and Space Administration, Washington, D. C.

TECHNICAL PROGRESS, FISCAL AFFAIRS, OBSOLESCENCE

C. Sarthou et al *In its* Tech. Progr. and Obsolescence Apr. 1966 p 1–41 refs (See N67-12626 03-34) CFSTI: HC $4.00/MF $1.00

An attempt is made to remove the apparent contradiction that exists between the belief that technological progress is the motive power of economic progress and the feeling that the cost of obsolescence leads to the ruin of both enterprise and State. The discussion demonstrates that the reduction of equipment life, as a consequence of the acceleration of technical progress, by no means reduces the revenue of the State, of enterprises, and of individuals and that everyone would lose if the service life of equipment would be prolonged beyond a certain point at which the total production has reached its maximum volume. R.N.A.

N67-12628*# National Aeronautics and Space Administration, Washington, D. C.

FISCAL MEASURES FOR ENCOURAGING SCIENTIFIC RESEARCH

F. Panel (Gen. Elec. Co.) *In its* Tech. Progr. and Obsolescence Apr. 1966 p 42–51 (See N67-12626 03-34) CFSTI: HC $4.00/MF $1.00

A recent study of the balance of payments has revealed that, although France has a considerable innovation power which shows in a positive balance of patents, it is deficient in the sector of exploiting ideas and using the discoveries and inventions. Various governmental fiscal measures designed to assist industry in basic research are to blame. It is shown that the only substantial tax advantage that the licenser of patents can enjoy is that of eliminating the fee for lease, a cancellation which, because of administrative concession, covers also the granting of licenses for manufacturing processes that are not patented. Present fiscal legislation induces the industrialist to prefer, over the constant gamble of research on an industrial scale, the security involved in acquiring a license. The royalties paid by the French industrialist to the licenser (most often a foreigner) can be deducted from his net income and thus lower the amount of taxes to be paid, whereas the royalties received from a license that the same industrialist grants to the same foreign firm are considered capital gain and thus are subject to a tax of 50%. R.N.A.

N67-12629*# National Aeronautics and Space Administration, Washington, D. C.

SPECIAL DISPOSITIONS FOR RESEARCH ACTIVITIES BY BUSINESS ENTERPRISES

In its Tech. Progr. and Obsolescence Apr. 1966 p 51–71 (See N67-12626 03-34) CFSTI: HC $4.00/MF $1.00

A certain number of French fiscal measures have been passed in favor of research activities. Some of these dispositions of specific interest for the management of patents and exploitation licenses are discussed and include the deduction of operating expense allocated to research, amortization of research equipment, recording of agreements on assignment of patents or granting of licenses, reapplication in franchise of certain capital gains, taxing of profits of inventors, and contribution to the company of patents or exploitation licenses. Besides fiscal measures, a number of dispositions are discussed which are designed to facilitate, by a more favorable tax structure, the formation of research companies and organizations. These include exemptions from transfer tax on certain gifts or bequests, the deduction of payments made for the benefit of research companies or organizations, and the fifty percent amortization of capital share of approved research organizations. R.N.A.

N67-12630*# National Aeronautics and Space Administration, Washington, D. C.

POTENTIALITIES AND DANGERS OF TECHNOLOGICAL EVOLUTION

J. R. Bright *In its* Tech. Progr. and Obsolescence Apr. 1966 p 72–101 (See N67-12626 03-34) CFSTI: HC $4.00/MF $1.00

Seven important technological trends, their principal domains of progress, means of typical progress, and results of significant importance are identified. They include transportation, energy production, organic and inorganic life, material characteristics, sensory capabilities, physical mechanization, and intellectual mechanization. A summary description of certain general commercial consequences of these trends is given followed by forecasts on the vast repercussions of technological evolution in industry. R.N.A.

N67-12631*# National Aeronautics and Space Administration, Washington, D. C.

RESEARCH, DEVELOPMENT, AND GROWTH

G. W. Wilson *In its* Tech. Progr. and Obsolescence Apr. 1966 p 102–109 refs (See N67-12626 03-34) CFSTI: HC $4.00/MF $1.00

The author attempts to correct what he considers to be fallacious statements made by Robert A. Solo in a recent article which raises a few important problems concerning the correlation between research and development and economic expansion. R.N.A.

N67-12632*# National Aeronautics and Space Administration, Washington, D. C.

REPLY TO G. W. WILSON

R. Solo *In its* Tech. Progr. and Obsolescence Apr. 1966 p 110–116 ref (See N67-12626 03-34) CFSTI: HC $4.00/MF $1.00

A rebuttal is presented to an article by Prof. George Wilson who attempted to correct some fallacious statements made in a previous article by this author concerning problems in the correlation between research and development and economic expansio R.N.

N67-12633*# National Aeronautics and Space Administration, Washington, D. C.

ANALYSIS OF THE "ROLE AND EFFECT OF TECHNOLOGY ON THE NATIONAL ECONOMY" OF THE UNITED STATES

J. C. Arinal *In its* Tech. Progr. and Obsolescence Apr. 1966 p 117–137 refs (See N67-12626 03-34) CFSTI: HC $4.00/MF $1.00

An analysis is presented on problems concerning the role and effect of technology on the U.S. economy and is based on Senate hearings in which various government officials and

representatives of universities and the business world participated. An attempt is made to give an overall presentation and a general and coordinated view of these problems rather than in the order in which they appeared during the hearings. Included are problems involving teaching and training; dissemination of information; the federal government, small and medium businesses, and their relations; and the link between the university and industry. Direct quotations from the hearings are also used. R.N.A.

N67-12720*# National Aeronautics and Space Administration, Washington, D. C.
NASA SPECIAL PUBLICATIONS THROUGH JULY 1966
1966 45 p refs
CFSTI: HC $2.00/MF $0.50 CSCL 05B

Publications of NASA thourgh July 1966 are catologued under the headings of: (1) General Series; (2) Handbooks, Data Compilations, Charts, and Tables; (3) Histories and Chronologies; (4) Technology Utilization Series; (5) Publications for Office of Manned Space Flight; and (6) Bibliographies and Other Reference Works. The general series section includes reports on recent space exploration activities, accounts of conferences, and state-of-the-art reviews in some scientific and technical fields. Bibliographies on industrial utilization of results of NASA space programs are included along with the special and continuing bibliographies. This semiannual listing presents titles with annotations in a reverse chronological order, as well as a subject index covering all of the publications. M.W.R.

N67-12833# Joint Publications Research Service, Washington, D. C.
SCIENTIFIC AND PHILOSOPHICAL APPLICATION OF CYBERNETICS IN MILITARY SCIENCE
3 Nov. 1966 19 p refs Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 1 Sep. 1966 CFSTI: $1.00
(JPRS-38476; TT-66-34901)

CONTENTS:

1. MILITARY APPLICATION OF CYBERNETICS D. Kazakov p 1–5 (See N67-12834 03-34)
2. PHILOSOPHICAL PROBLEMS OF CYBERNETICS V. Bokarev p 7–17 refs (See N67-12835 03-34)

N67-12834# Joint Publications Research Service, Washington, D. C.
MILITARY APPLICATION OF CYBERNETICS
D. Kazakov *In its* Sci. and Phil. Appl. of Cybernetics in Mil. Sci. 3 Nov. 1966 p 1–5 (See N67-12833 03-34) CFSTI: $1.00

Presented is a discussion of the applicability of methods of observation, comparison, statistical analysis, modeling, cybernetics, and bionics to the solution of military problems. S.C.W.

N67-12835# Joint Publications Research Service, Washington, D. C.
PHILOSOPHICAL PROBLEMS OF CYBERNETICS
V. Bokarev *In its* Sci. and Phil. Appl. of Cybernetics in Mil. Sci. 3 Nov. 1966 p 7–17 refs (See N67-12833 03-34) CFSTI: $1.00

Philosophical problems associated with the relationship of cybernetics to other sciences, the objective content of its basic concepts, electronic machines and the nervous system of man, and the social value of cybernetics; are discussed. S.C.W.

N67-12843# Indian Inst. of Science, Bangalore.
JOURNAL OF THE INDIAN INSTITUTE OF SCIENCE, VOLUME 48, NO. 2 AND 3, APRIL AND JULY 1966
Jul. 1966 84 p refs
CFSTI: HC $3.00/MF $0.75

CONTENTS:

1. MICROBIAL DECOMPOSITION OF PECTIC SUBSTANCES. IV: BACTERIA DECOMPOSING PECTIN WITH PARTICULAR REFERENCE TO SOME XANTHOMONAS SP M. H. Bilimoria p 53–64 refs (See N67-12844 03-04)
2. THERMODYNAMIC PROPERTIES OF CARBON TETRACHLORIDE D. N. Seshadri, D. S. Viswanath, and N. R. Kuloor p 65–80 refs (See N67-12845 03-06)
3. TRANSPORT PROCESSES IN A MULTICOMPONENT ASSEMBLY. II: FOKKER-PLANCK FORMALISM C. Devenathan, M. R. Raghavachar, and R. Babu p 81–97 refs (See N67-12846
4. SUITABILITY OF THE HIGH TEMPERATURE PRE-INCUBATION METHOD FOR ISOLATION OF PECTINOLYTIC ACTINOMYCETES A. D. Agate p 98–101 refs (See N67-12847 03-04)
5. SURFACE WAVE PROPAGATION THROUGH ANISOTROPIC CIRCULAR, CYLINDRICAL DIELECTRIC ORD WAVEGUIDE D. K. Paul p 102–125 refs (See N67-12848 03-07)

N67-12904*# Northwestern Univ., Evanston, Ill. Technological Inst.
PROGRAM OF RESEARCH ON THE MANAGEMENT OF RESEARCH AND DEVELOPMENT Annual Report, 1965–1966 and Program Summary, 1960–1966
Albert H. Rubenstein Sep. 1966 54 p refs *Its* Rept.-66/32
(Grants NsG-495; NSF G-24442; PHS LM-00098-01; Contracts NR-047-052; N00014-66-C0020A01)
(NASA-CR-80199) CFSTI: HC $3.00/MF $0.50 CSCL 05A

Progress is reported on several projects within a program of research on the management of research and development. The current projects include idea flow in research and development; control of research and development in decentralized organizations; strategies for organization and diffusion of research in developing countries; research and development responses to crises; source of research and development achievements in electronics since 1945; the acquisition and development of new technical skills in research and development; integration and utilization of management science activities in organizations; transition and interface problems between phases of research, development, and application; the information seeking behavior of researchers; project selection in research and development; key researchable problem areas in research and development management; environment and management factors influencing the performance of research and development groups; and other related activities including studies of methods of research-on-research. Author

N67-12958# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
EFFECTIVENESS ENGINEERING ORGANIZATION IN THE AEROSPACE INDUSTRY
S. L. Roush and J. L. Maybell Oct. 1966 23 p refs
(Douglas Paper-3768)

Effectiveness engineering is the integrated application of selected engineering disciplines to design and development. These disciplines are applied to basic system and hardware design so as to optimize their collective contributions to the successful accomplishment of the mission of the system. The hardcore of these engineering disciplines includes reliability, maintainability, cost analysis, human factors, system safety, and value engineering, all of a line design support nature. Effectiveness engineering is a critical activity of system effectiveness. However, the increasing number of such disciplines in itself became a problem to those

very managers who fostered them. A properly structured organization, coupled with clear concise operating instructions and procedures, is clearly the first step in the solution to the engineering portion of this problem. This paper presents a solution to the first part of this preliminary step; that is, a properly structured organization for effectiveness engineering. Author

N67-12959# National Aeronautics and Space Council, Washington, D. C.
THE MEANING OF THE SPACE AGE
Edward C. Welsh 6 May 1966 7 p Presented at the Churchman's Club, Baltimore, 5 May 1966

The space age is considered in terms of its scientific, technological, economic, spiritual, and political effects on national character. The history of the space program is briefly reviewed, and the question of life on other planets is examined. Use of satellites in the field of communications is mentioned with regard to space applications. S.P.

N67-13107*# California Univ., Los Angeles. Graduate School of Business Administration.
THE PRE-SOLICITATION PHASE OF GOVERNMENT R&D CONTRACTING
Gaylord E. Nichols, Jr. 15 Apr. 1966 28 p refs
(NASA-CR-80474; NASA-RP-10) CFSTI: HC $2.00/MF $0.50 CSCL 05A

The decision environment that exists during the pre-solicitation phase of research and development contracts awarded by a government agency to private contractors (specifically NASA space research and development center, and two major aerospace companies) is investigated. The report attempts to relate the effects of contractor activity at this phase to contractor selection. Examination of information derived from the above sources indicate that important competitive factors operate prior to the formal initiation of the procurement process which not only affect the project planning and initiation, but also heavily influence the eventual selection of a specific contractor. This early activity is considered to be sufficiently pervasive in the procurement process to be given the status of a distinct phase in the procurement cycle (the pre-solicitation phase). L.S.

N67-13118*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ANNUAL PROGRESS REPORT, 1966
Oct. 1966 118 p refs
(Grant NsG-633)
(NASA-CR-80439) CFSTI: HC $4.00/MF $0.75 CSCL 14B

Work progress is summarized for the following projects: (1) Mechanics of Rarefied Gases; (2) Plasma Dynamics; (3) Hypersonic Gasdynamics and Blast Wave Phenomena; (4) Energy Conversion; (5) Aerodynamic Noise, (6) Subsonic Aerodynamics, (7) Aerospace Flight Dynamics; (8) Materials Science and Structures; (9) Upper Atmospheric Research; (10) Molecular Beams and Surface Interactions; and (11) Industrial and Architectural Aerodynamics. Photographs, graphs, charts, diagrams, and tables of data are included in support of the summaries. L.S.

N67-13187*# National Aeronautics and Space Administration, Washington, D. C.
ASSESSING TECHNOLOGY TRANSFER
Richard L. Lesher and George J. Howick 1966 121 p refs
(NASA-SP-5067) GPO: HC $0.50 CFSTI: MF $0.75 CSCL 14A

Presented is the abridgement of a report prepared for the National Commission on Technology, Automation, and Economic Progress that: (1) identifies and assesses the past and current effects of technological change in the United States; (2) identifies and describes the impact of technological and economical change on production and employment of the Nations's social structure; (3) defines areas of community and human needs that can be eliminated by application of new technologies; and (4) assesses the most effective means for channeling new technologies into civilian industries where accelerated technological advancements will yield the most benefits. G.G.

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